E14

High Speed Rail (West Midlands - Crewe)

Environmental Statement

Volume 2: Community Area report

CA2: Colwich to Yarlet

ES 3.2.1.2

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July 2017

ES 3.2.1.2

Department for Transport

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

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Preface

The Environmental Statement

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

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

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

Consultation on the Environmental Statement

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

Structure of the Environmental Statement

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

The ES documentation comprises the following:

Non-technical summary

This provides:

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

Glossary of terms and list of abbreviations

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

Volume 1: Introduction and methodology

This provides:

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

Volume 2: Community area reports and map books

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

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

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

Volume 3: Route-wide effects

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

Volume 4: Off-route effects

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

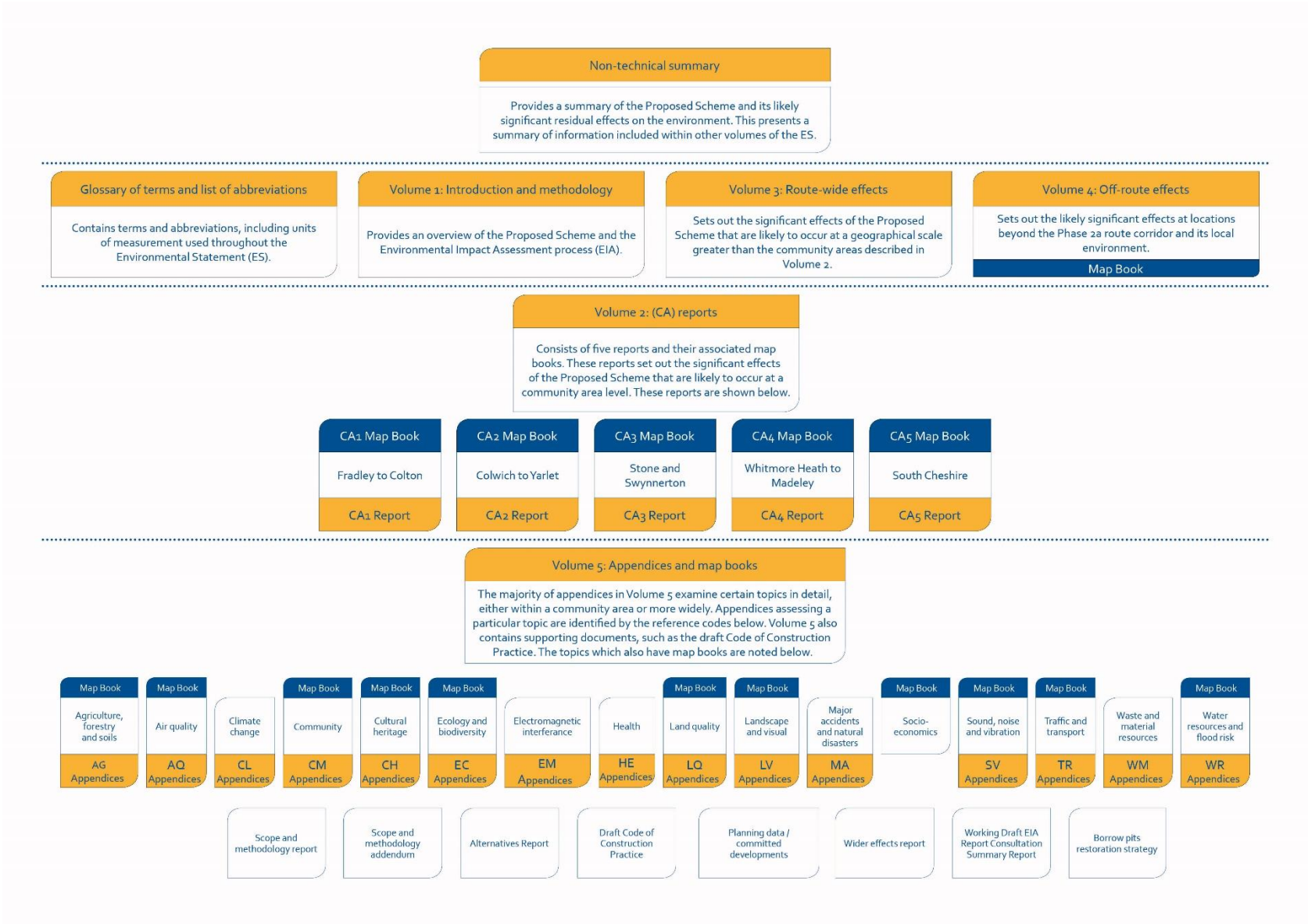
Volume 5: Appendices and map books

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

Background information and data (BID)

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

Figure 1: Structure of the Environment Statement



1 Introduction

1.1 Introduction to HS2

1.1.1 High Speed Two (HS2) is a new high speed railway proposed by the Government to connect major cities in Britain. Stations in London, Birmingham, Leeds, Manchester and East Midlands will be served by high speed trains running at speeds of up to 225mph (360kph). Trains will also run beyond the HS2 network to serve destinations including South Yorkshire, Liverpool, Glasgow, Edinburgh, Newcastle and York.

1.1.2 HS2 will be built in phases. Phase One comprises the first section of the HS2 rail network of approximately 143 miles (230km) between London and the West Midlands and is planned to become operational in 2026. It was the subject of an Environmental Statement (ES) deposited with the High Speed Two (London – West Midlands) Bill in 2013. Subsequent ESs were deposited with Additional Provisions to that Bill in 2014 and 2015. The High Speed Two (London – West Midlands) Bill received Royal Assent in February 2017 and initial works on Phase One have commenced.

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

1.1.4 Phase Two will be constructed in two phases:

- Phase 2a (the Proposed Scheme): the western section of Phase Two between the West Midlands and Crewe, comprising approximately 36 miles (58km) of HS2 main line (including the section which would connect with and form the first part of Phase 2b) and two spurs (approximately 4 miles (6km)) south of Crewe that will allow trains to transfer between the HS2 main line and the existing WCML. Construction of the Proposed Scheme will commence in 2020, ahead of the rest of Phase Two, with operation planned to start in 2027, six years earlier than originally planned bringing more of the benefits of HS2 to the North sooner; and
- Phase 2b: comprising the remainder of Phase Two, between Crewe (where it would connect with the Proposed Scheme) and Manchester, and between the West Midlands and Leeds. Phase 2b will be the subject of a separate hybrid Bill, with construction expected to commence in 2023 and operation planned to start by 2033.

1.1.5 The Proposed Scheme will connect with Phase One at Fradley, to the north-east of Lichfield, and to the WCML south of Crewe, providing onward services beyond the HS2 network, and between the north-west of England and Scotland.

1.1.6 The Proposed Scheme has been the subject of an environmental impact assessment (EIA). During the development of the Phase 2a proposals, a working draft EIA Report was consulted on to help inform the design and assessment of the Proposed Scheme.

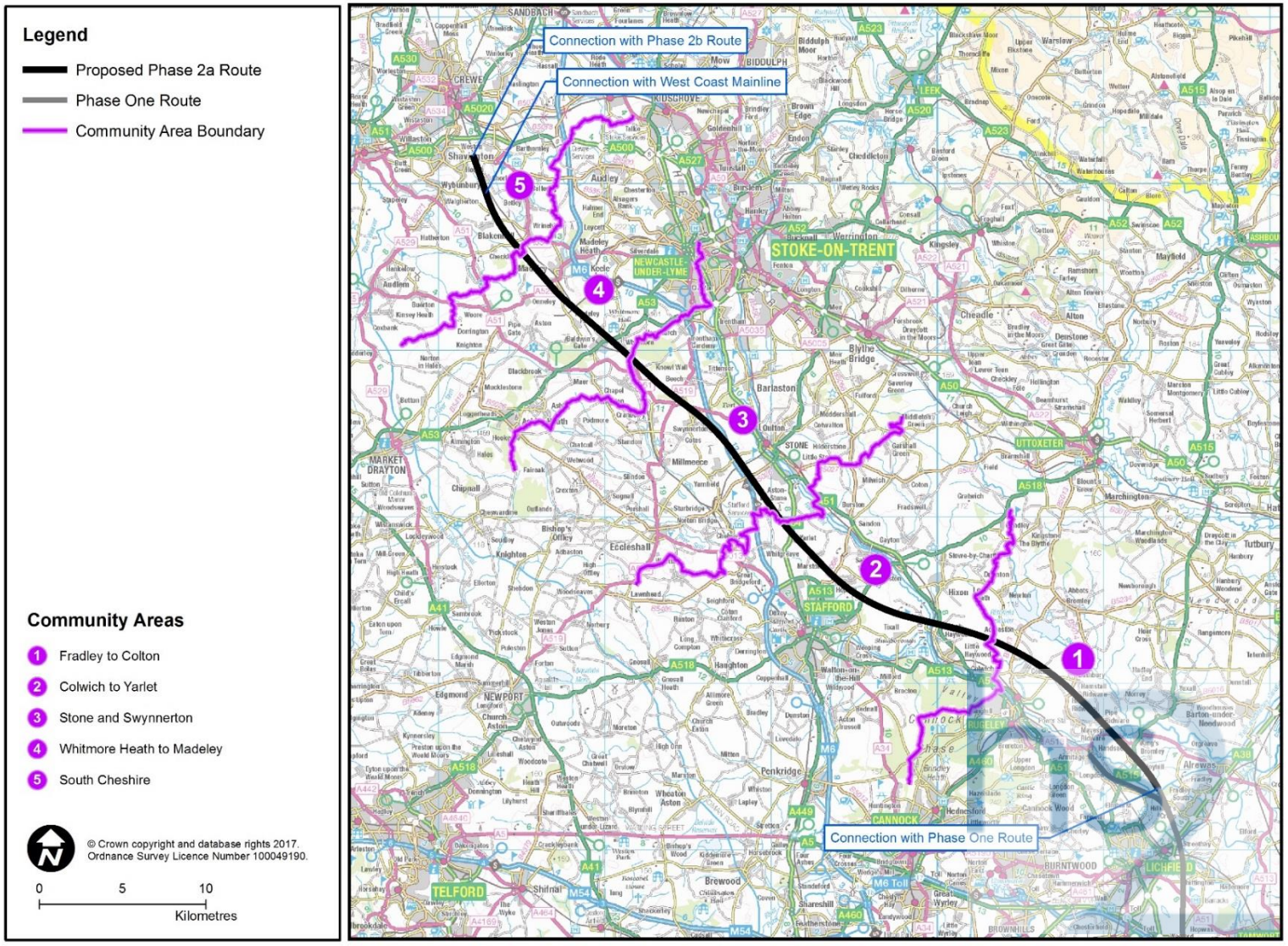
1.1.7 The findings of the assessment of the Proposed Scheme are reported in an Environmental Statement (the ES), of which this Volume 2 report forms a part. The ES

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

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

[1] Standing Order 27A of the Standing Orders of the House of Commons relating to private business (environmental assessment) - 2015, House of Commons.
[2] Standing Orders of the House of Lords - Private Business – 2015, House of Lords.

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



1.2 Purpose of this report

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

1.3 Structure of this report

1.3.1 This report is divided into the following sections:

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

1.3.2 Each environmental topic section comprises:

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

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

1.3.3 Environmental effects have been assessed in accordance with the methodology set out in Volume 1 (Section 8), the EIA Scope and Methodology Report (SMR) (Volume 5: Appendix CT-001-001) and the EIA SMR Addendum (Volume 5: Appendix CT-001-002). The purpose of the SMR Addendum is to set out where the assessment methodology presented within the SMR has been amended or developed, for example, as a result of changes in legislation or industry best practice guidance or where methodologies have undergone refinement in the course of preparation of the ES.

1.3.4 The Proposed Scheme in the Colwich to Yarlet area is shown in Volume 2: CA2 Map Book on the Map Series CT-05 (construction) and CT-06 (operation), and should be read in conjunction with this report. There is some flexibility during detailed design to alter the horizontal and vertical alignments and other details within the limits shown on the plans and sections submitted to Parliament and as set out in the Bill. This flexibility is included within the scope of the environmental assessment. Further explanation is provided in Volume 1, Section 1.

1.3.5 In addition to the environmental topics covered in Sections 4 to 15 of this report, electromagnetic interference is addressed in Volume 1 and climate change, major accidents and natural disasters, and waste and material resources are addressed in Volume 3 on a route-wide basis. An assessment of potential environmental effects beyond the Phase 2a route corridor and its associated local environment has also been undertaken and this 'off-route' assessment is reported in Volume 4.

1.3.6 Supporting technical information, including technical appendices and map books, relating to the assessment in this Volume 2 report is provided in Volume 5 of the ES.

1.3.7 In addition to the technical appendices and map books in Volume 5, certain reports and maps containing background information and data (BID) have been produced, which do not form part of the ES. These documents are available on the HS2 Ltd website. The BID reports and maps present survey information, collated from published and unpublished sources, and other background analysis, and are referenced at various places within the ES.

2 Overview of the area and description of the Proposed Scheme

2.1 Overview of the area

General

2.1.1 The Colwich to Yarlet area covers an approximately 15.2km section of the Proposed Scheme passing through the parishes of Colwich, Ingestre with Tixall, Hopton and Coton, Whitgreave and Marston, within the local authority areas of Stafford Borough Council (SBC) and Staffordshire County Council (SCC). The boundary between Colton parish and Colwich parish forms the southern boundary of this section. The boundary between Marston parish and Stone Rural parish forms the northern boundary of this section.

2.1.2 As shown in Figure 2, the Fradley to Colton area (CA1) lies to the south and the Stone and Swynnerton area (CA3) lies to the north.

Settlement, land use and topography

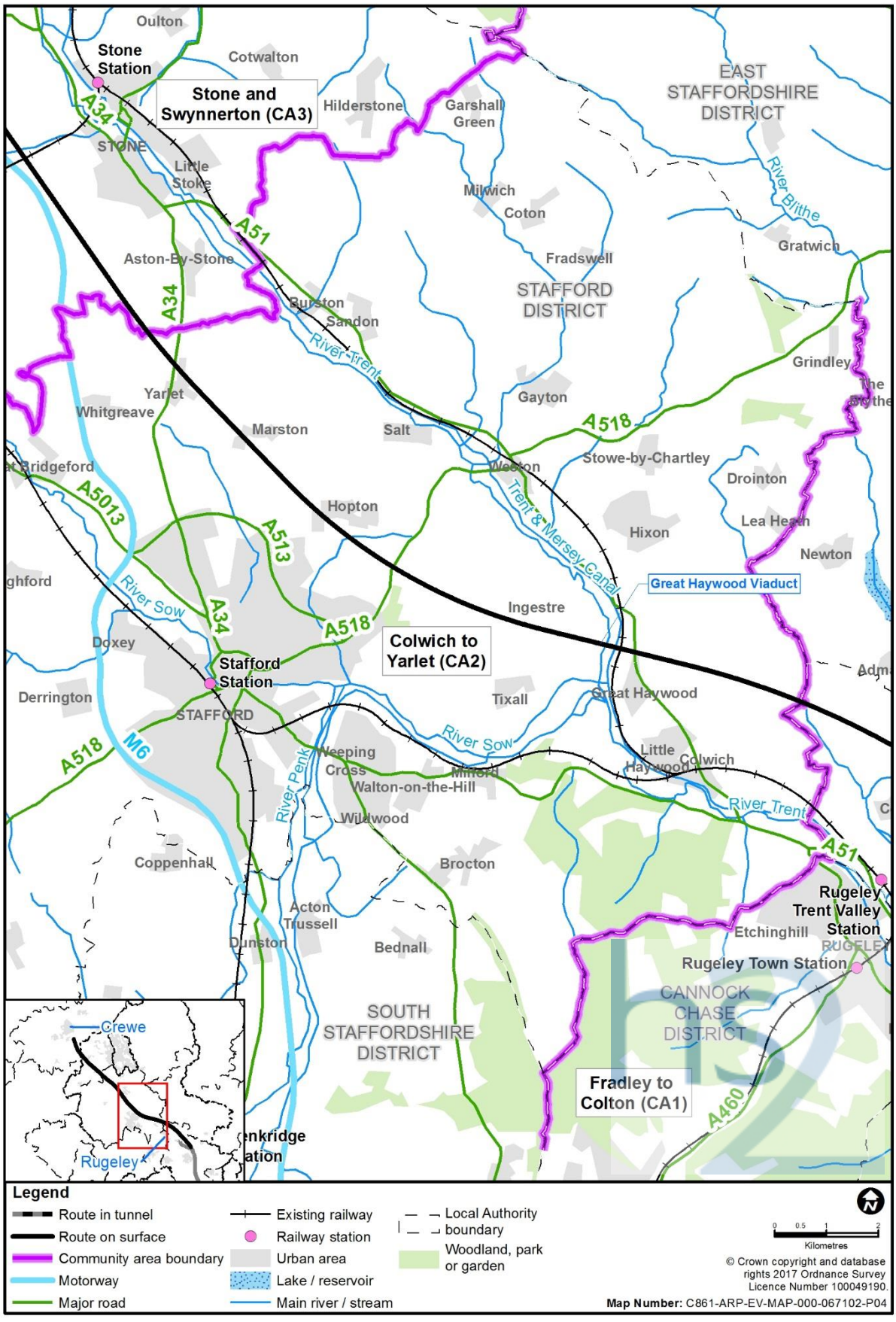
2.1.3 The Colwich to Yarlet area is predominantly rural in character, with agriculture being the main land use, interspersed with small villages and a scattering of isolated dwellings and farmsteads. The main residential areas are Little Haywood, Great Haywood and Stafford. Within the wider rural area there are a number of other residential areas, including Ingestre, Tixall, Hopton, Marston and Yarlet.

2.1.4 In the southern part of the Colwich to Yarlet area, the route of the Proposed Scheme will pass approximately 40m from Mayfield Children's Home, which occupies the Grade II listed Moreton House. Mayfield Children's Home is a specialist residential children's home linked to an independent specialist school, Rugeley School, which is located on the outskirts of Blithbury in Lichfield in the Fradley to Colton area (CA1). The route will continue towards the floodplain of the River Trent crossing the existing Macclesfield to Colwich railway before running adjacent to Great Haywood Marina and crossing the Trent and Mersey Canal and the River Trent. Shugborough Park, including Shugborough Hall (Grade I listed building) is located approximately 1km south of the route of the Proposed Scheme. The route will run adjacent to Ingestre Park and through Ingestre Park Golf Club, with Pasturefields Salt Marsh Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) approximately 900m north of the route of the Proposed Scheme. The route will continue through an area in the southern part of the Staffordshire County Showground site (predominantly used for car parking and camping) and the settlement of Hopton and past a number of Ministry of Defence (MoD) residential properties. The route will then pass Marston, running beneath the A34 Stone Road, and continue north towards the village of Yarlet.

2.1.5 The highest ground in the area is a ridge near the A34 Stone Road, which rises to approximately 140m above Ordnance Datum (AOD). Here, the route of the Proposed Scheme will pass beneath the A34 Stone Road in cutting and past Yarlet towards Peasley Bank. Significant topographical features within the Colwich to Yarlet area

include the broad valley of the River Trent and River Sow, which meet at Great Haywood, along the foot of the high ground of Cannock Chase.

Figure 3: Area context map



Key transport infrastructure

2.1.6 Principal highways within this area include: the M6; the A51 Lichfield Road, as it passes through Great Haywood; the A518 Weston Road, as it passes Staffordshire County Showground; the A34 Stone Road; the A513 Beaconside; and the B5066 Sandon Road. These highways provide links to Stafford and the wider transport network. The route of the Proposed Scheme will cross over the A51 Lichfield Road and beneath the A518 Weston Road, the B5066 Sandon Road and the A34 Stone Road. There will be a minor realignment of the A518 Weston Road and the B5066 Sandon Road west of their current location. The route of the Proposed Scheme will cross over the existing Macclesfield to Colwich Line and the Trent and Mersey Canal.

2.1.7 The route of the Proposed Scheme will cross several Public Rights of Way (PRoW), including local access roads, bridleways and public footpaths, which provide important links between scattered dwellings and surrounding villages. These include the Trent and Mersey Canal Walk, Staffordshire Way and Two Saints Way.

Socio-economic profile

2.1.8 Within the SBC area there is a wide spread of business types reflecting a diverse range of commercial activities. The professional, scientific and technical sector accounts for the largest proportion of businesses (13%), with agriculture, forestry and fishing the second largest (11%) followed by retail and construction (10% each)[3].

2.1.9 According to the Annual Population Survey (2016)[4], the employment rate[5] within the SBC area was 75% (60,300 people), which is higher than that recorded for both the West Midlands (71%) and England (74%). In 2016, unemployment[6] in the SBC area was 4%, which is lower than the West Midlands and England.

2.1.10 According to the Annual Population Survey (2016)4, 46% of SBC residents aged 16-64 were qualified to National Vocational Qualification Level 4 and above, while 7% of residents had no qualifications.

Notable community facilities

2.1.11 The main concentrations of community facilities are in the larger settlements of Little Haywood, Great Haywood and Stafford. Moreton, Ingestre, Tixall, Hopton, Marston and Yarlet are smaller villages and hamlets that are located closer to the route of the Proposed Scheme than the larger settlements listed, and provide a smaller number of local services.

2.1.12 There are five schools located within 1km of the route of the Proposed Scheme: St. John's Roman Catholic Primary School, Anson Church of England (Aided) Primary School, the Weston Road Academy, Veritas Primary Academy and Yarlet School.

[3] Office for National Statistics; UK business counts – local units 2015; Available online at: https://www.nomisweb.co.uk
[4] Annual Population Survey, (2016), NOMIS; Available online at: http://www.nomisweb.co.uk
[5] The proportion of working age (16-64 year olds) residents that is in employment.
[6] 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.

2.1.13 Moreton is a small hamlet approximately 1.9km north-east of Little Haywood. Moreton has two notable community facilities. Mayfield Children's Home, which occupies the Grade II listed Moreton House, is a specialist residential home for students of Rugeley School, located in the Fradley to Colton area (CA1). All of the children are severely autistic, with many also having special behavioural, learning or communication needs. Upper Moreton Farm is a Community Interest Company (CIC) that provides care services alongside being a working farm and is part of the Care Farming UK initiative. It provides educational visits for local schools, and rural therapy and care farming for people with mental health problems, multiple learning difficulties or emotional difficulties, and people who have experienced abuse or neglect.

2.1.14 Ingestre and Little Ingestre are adjoining villages, located approximately 2.3km and 1.5km north-west of Great Haywood respectively. Community facilities include St. Mary the Virgin (Ingestre Parish) Church, which is historically linked with Ingestre Hall; Ingestre Hall Residential Arts Centre; Little Ingestre House care home; Ingestre Stables; The Orangery; and Ingestre Park Golf Club.

2.1.15 Tixall is a small village, located approximately 2km south-west of Great Haywood. The village includes St John the Baptist Church and a village hall.

2.1.16 Hopton is a small village, including residential properties located within the secure MoD Stafford Barracks. Community facilities within the village include St Peter's Church, playing fields and a village hall.

2.1.17 Marston and Yarlet are small adjoining hamlets. St. Leonard's Church is located within Marston. Yarlet School is located to the east of the A34 Stone Road, and provides independent education for children aged between two and 13 years. The school grounds include a chapel and overnight accommodation for part-time boarding.

Recreation, leisure and open space

2.1.18 This is a predominantly rural area, with open space, woodland and some farmland. It is crossed by several PRoW, including the Trent and Mersey Canal Walk, Staffordshire Way, and Two Saints Way. Cannock Chase Area of Outstanding Natural Beauty (AONB) is located approximately 600m to the south of the route of the Proposed Scheme at its closest point in the Colwich to Yarlet area, and incorporates a wide range of outdoor recreational facilities, including Shugborough Park, which are of regional importance.

2.1.19 Great Haywood Marina is located off the Trent and Mersey Canal, north-west of Great Haywood. It provides temporary residential mooring points for canal boats and includes a convenience store, a café and a farm shop, which are located near to the entrance to the marina.

2.1.20 Ingestre Hall Residential Arts Centre is located to the west of Ingestre. The remnants of the Ingestre estate grounds form Ingestre Park Golf Club, a private members' club with approximately 650 members; the club house is used for a variety of social and recreational events and can cater for up to 200 people.

2.1.21 Staffordshire County Showground is located to the north-east of Stafford, accessed from the A518 Weston Road. The showground is a large agricultural events centre, which is of regional importance.

Policy and planning context

Planning framework

2.1.22 HS2 is not included or referred to in many local plans, given that it is being developed on a national basis to meet a national need.

2.1.23 However the Proposed Scheme is shown on the planning policy map for Lichfield District Local Plan Strategy 2008-2029[7] and referenced as to be considered in addition to development of a strategic development allocation (Policy Lichfield 5: East of Lichfield (Streethay)). Cannock Chase Local Plan (Part 1)[8] also refers to the scheme and the improved connectivity it would bring to the area. All, relevant local plan documents and policies have been considered in relation to environmental topics, as part of considering the Proposed Scheme in the local context.

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

- Staffordshire and Stoke-on-Trent Joint Waste Core Strategy 2010 - 2026 (Adopted 2013)[9];
- The Minerals Local Plan for Staffordshire 2015 to 2030 (Adopted 2017)[10];
- The Plan for Stafford Borough 2011 - 2031 Part 1 (Adopted 2014)[11];
- The Plan for Stafford Borough 2011-2031 Part 2 (Adopted 2017)[12];
- Colwich Neighbourhood Plan 2011-2031 (Adopted 2016)[13];
- Hixon Neighbourhood Plan 2011-2031 (Adopted 2016)[14];
- Lichfield District Local Plan (Adopted 1998 – saved policies)[15]; and
- Lichfield District Council Local Plan Strategy 2008-2029 (Adopted 2015)[16].

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

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[7] Lichfield District Local Plan Strategy 2008-2029. Available online at: https://www.lichfielddc.gov.uk/Council/Planning/The-local-plan-and-planning-policy/Resource-centre/Local-Plan-documents/Downloads/Local-Plan-Strategy/Lichfield-District-Local-Plan-Strategy-2008-2029-1.pdf
[8] Cannock Chase Local Plan (Part 1). Available online at: https://www.cannockchasedc.gov.uk/sites/default/files/local_plan_part_1_09.04.14_low_res.pdf
[9] Staffordshire and Stoke-on-Trent Joint Waste Core Strategy 2010 - 2026 (Adopted 2013). Available online at: https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/wastelocalplan/Adopted-Staffordshire-and-Stoke-on-Trent-Joint-Waste-Local-Plan-(2010-to-2026)-(adopted-March-2013).pdf
[10] The Minerals Local Plan for Staffordshire 2015 to 2030 (Adopted 2017). Available online at: https://www.staffordshire.gov.uk/environment/planning/policy/thedevelopmentplan/mineralslocalplan/mineralsLocalPlan.aspx
[11] The Plan for Stafford Borough 2011 - 2031 Part 1 (Adopted 2014). Available online at: http://www.staffordbc.gov.uk/live/Documents/Planning%20Policy/Plan%20for%20Stafford%20Borough/PFSB-Adoption.pdf
[12] The Plan for Stafford Borough 2011-2031 Part 2 (Adopted 2017). Available online at: http://www.staffordbc.gov.uk/live/Documents/Planning%20Policy/Plan%20for%20Stafford%20Borough/PFSB-Part-2-Adoption.pdf
[13] Colwich Neighbourhood Plan 2011-2031 (Adopted 2016). Available online at: http://www.staffordbc.gov.uk/live/Documents/Planning%20Policy/Neighbourhood%20Planning/Colwich/Colwich_Neighbourhood_Plan.pdf
[14] Hixon Neighbourhood Plan 2011-2031 (Adopted 2016). Available online at: http://www.staffordbc.gov.uk/live/Documents/Planning%20Policy/Neighbourhood%20Planning/Hixon/Hixon-Neighbourhood-Plan.pdf
[15] Lichfield District Local Plan (Adopted 1998 – saved policies). Available online at: https://www.lichfielddc.gov.uk/Council/Planning/The-local-plan-and-planning-policy/Local-plan/Downloads/1998-lichfield-district-local-plan-saved-policies.pdf
[16] Lichfield District Council Local Plan Strategy 2008-2029 (Adopted 2015). Available online at: https://www.lichfielddc.gov.uk/Council/Planning/The-local-plan-and-planning-policy/Resource-centre/Local-Plan-documents/Downloads/Local-Plan-Strategy/Lichfield-District-Local-Plan-Strategy-2008-2029-1.pdf

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

Committed development

2.1.27 Committed developments are defined as developments with planning permission and sites allocated for development or safeguarded for minerals in adopted development plans, on or close to the land required for the Proposed Scheme. Allocations and MSA in the submission drafts of the Minerals Local Plan for Staffordshire (2015) and the Plan for Stafford Borough: Part 2 (2015) have also been included as committed developments. These are listed in Volume 5: Appendix CT-004-000, Planning data, and are shown in Volume 5 Planning Data/Committed Development Map Book: Maps CT-13-105b to CT-13-109a-R1.

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

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

2.1.30 There are no potential cumulative developments identified that are relevant to the topic assessments in the Colwich to Yarlet area.

2.1.31 Where a committed development lies wholly or partly within the land required for the Proposed Scheme, consideration has been given as to whether it will be commenced or completed in its proposed form. These developments are noted in Volume 5: Appendix CT-004-000.

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

Changes to the design since the working draft EIA Report

2.1.33 Since the working draft EIA Report was published a number of changes have been introduced to the Proposed Scheme. The key changes include (all dimensions below are approximate unless stated otherwise):

- increase in the length of Moreton cutting (formerly referred to as Coley cutting) from 1.5km to 1.8km at its northern end, and subsequent reduction in the length of the Trent South embankment by 200m (see Volume 2: Map CT-06-210, E5 to CT-06-212, F6);

- introduction of the Colwich Bridleway 58 accommodation underbridge to provide agricultural vehicle access across the route of the Proposed Scheme (see Volume 2: Map CT-06-211, B5 to B6);
- reduction in the height of the Great Haywood viaduct from 16.5m to 15.4m above existing ground level, in the central section, to tie in with the reduction in height of the northern end of the Trent South embankment, from 16.1m to 14.5m above existing ground level (see Volume 2: Map CT-06-212, F6 to B6);
- introduction of the Ingestre green overbridge, on a precautionary basis, to facilitate ecological connectivity between fragmented habitats, see Section 8 for further details (see Volume 2: Map CT-06-214, J6 to I5);
- introduction of Trent Walk underbridge to provide agricultural access and access to residential properties along Trent Walk from the south (see Volume 2: Map CT-06-215, F5 to F6);
- introduction of the Hopton and Coton new footpath overbridge to provide a new pedestrian only access between Mount Edge and Hopton (see Volume 2: Map CT-06-216, D5 to D6);
- relocation of the Yarlet auto-transformer station from the location proposed in the working draft EIA Report on the western side of the route of the Proposed Scheme. It will be an express feeder auto-transformer station of 90m by 45m and will be located to the east and 250m further north along the route (see Volume 2: Map CT-06-219a, D5);
- major utilities works including:
  - diversion of two National Grid high pressure gas pipelines (1,050mm and 12 inch in diameter) across the route of the Proposed Scheme, to the east of Colwich Bridleway 58 and the west of the Colwich Bridleway 35 accommodation underbridges respectively (see Volume 2: Map CT-06-211, E6 to D5 and C6 to A4);
  - diversion of a British Pipeline Agency 10 inch diameter fuel pipeline adjacent to the route of the Proposed Scheme, to the south of the Trent South embankment (see Volume 2: Map CT-06-212, J8 to F8);
  - change to the diversion route of a National Grid 1,050mm diameter high pressure gas pipeline adjacent to the route of the Proposed Scheme, to the north of the Great Haywood viaduct (see Volume 2: Map CT-06-212, D5 to B2);
  - diversion of a British Pipeline Agency 10 inch diameter fuel pipeline across the route of the Proposed Scheme, to the north of the Trent North embankment, east of Ingestre underbridge (see Volume 2: Map CT-06-213, F7 to CT-06-214, F5);
  - diversion of a National Grid 12 inch diameter high pressure gas pipeline across the route of the Proposed Scheme, to the south of the Brancote South cutting, west of Ingestre underbridge (see Volume 2: Map CT-06-213, C5 to CT-06-214, H7); and

  - diversion of a British Pipeline Agency 10 inch diameter fuel pipeline across the route of the Proposed Scheme, to the south of the Hopton North cutting, north-west of the Hopton and Coton Bridleway 11 accommodation overbridge (see Volume 2: Map CT-06-217, G5 to D7);

- temporary worker accommodation for up to 240 workers at the Trent South embankment main compound near Great Haywood. The compound will also include an asphalt batching plant, a concrete batching plant and a viaduct launching yard to facilitate construction of the Great Haywood viaduct (see Volume 2: Map CT-05-212, F2 to F6); and
- transfer nodes for the storage, loading and unloading of bulk earthworks materials at the Trent South embankment main compound, the Hopton South cutting satellite compound and the Yarlet South cutting satellite compound.

2.1.34 The location and configuration of construction compounds, stockpiles and site haul routes have been considered as part of the design development. Further mitigation, such as noise barriers, landscape earthworks, green bridges, compensatory planting and replacement ponds and wetlands throughout the Colwich to Yarlet area has been developed to reduce impacts on receptors.

2.2 Description of the Proposed Scheme

General

2.2.1 The following section describes the main features of the Proposed Scheme in the Colwich to Yarlet area, including the proposed environmental mitigation measures that have been identified. Further information on typical permanent features is provided in Volume 1, Section 5. Similarly, a general description of the approach to mitigation is provided in Volume 1, Section 9. Some of the ecological mitigation described in this section has been provided on a precautionary basis. This is set out in Section 8, Ecology and biodiversity.

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

Overview

2.2.3 The Proposed Scheme through the Colwich to Yarlet area will be approximately 15.2km in length and will lie within the SCC and SBC areas. The route will extend from the west of Moreton in the south and then north towards Hopton and on to Yarlet.

2.2.4 All dimensions in the sections below are approximate.

2.2.5 In the Colwich to Yarlet area, the route of the Proposed Scheme will be carried on the following features:

- viaduct for a total length of 780m (Great Haywood viaduct);
- cutting for a total length of 8.9km (Moreton, Brancote South, Brancote North, Hopton South, Hopton North and Yarlet South cuttings); and

- embankment for a total length of 5.5km (Moreton North, Trent South, Trent North, Hopton, Marston South and Marston North embankments).

2.2.6 Embankments and cuttings have been labelled according to their predominant physical characteristics. It is important to note that a number of embankments and cuttings vary as to their depth of cutting or height of embankment as a result of the topography through which the railway passes. Moreover, there are some sections of cutting over which the railway passes at grade or above ground and sections of embankment which pass at grade or below ground level. In the Colwich to Yarlet area, this applies to the following embankments and cuttings:

- Brancote North cutting has some sections where the railway passes up to 3m above existing ground level;
- Hopton South cutting has some sections where the railway passes up to 3m above existing ground level;
- Hopton North cutting has some sections where the railway passes up to 3m above existing ground level;
- Marston South embankment has some sections where the railway passes up to 1m below existing ground level; and
- Marston North embankment has some sections where the railway passes at grade and up to 2m below existing ground level.

2.2.7 The Proposed Scheme is described in six separate sections below.

2.2.8 In the Colwich to Yarlet area, the route runs in a general south-east to north-west orientation towards the boundary with the Stone and Swynnerton area (CA3). In general, features are described along the route of the Proposed Scheme from south-east to north-west and to the south and north as features cross the route as shown on Map Series CT-06 in the Volume 2: CA2 Map Book.

Colwich to Colwich Bridleway 35 accommodation overbridge

2.2.9 The route of the Proposed Scheme in this section will continue from the Fradley to Colton area (CA1) west towards Moreton House on Moreton North embankment. The route will continue into Moreton cutting to the Colwich Bridleway 35 accommodation overbridge.

2.2.10 This section of route is illustrated on maps CT-06-210, CT-06-210 L1 and CT-06-210 L2 in the Volume 2: CA2 Map Book.

2.2.11 Key features of this 1.7km section will include:

- diversion of a Western Power Distribution 132kV overhead line to underground cable, starting in the Fradley to Colton area (CA1) and continuing into the Colwich to Yarlet area for 175m, running to the north of the route of the Proposed Scheme (see Volume 2: Map CT-06-210, J7 to H2);
- Moreton North embankment, 695m and up to 9m in height. Landscape earthworks, with landscape mitigation planting, will help integrate the Proposed Scheme into the surrounding landscape. Noise fence barriers, up to

3m in height, will be located along the southern and northern sides of Moreton North embankment, continuing on to Moreton cutting. The barriers to the south will provide acoustic screening for properties at Moreton Grange Farm and the barrier to the north will provide acoustic screening for properties at Moreton Farm (see Volume 2: Map CT-06-210, J6 to F5);

- areas of woodland habitat creation to the north of the Moreton North embankment to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-210, I5 to G5);
- two ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, to the south of the Moreton North embankment in an area of woodland habitat creation to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-210, I4 to F4 and I6 to H7);
- an area of grassland habitat creation to the south of the Moreton North embankment to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-210, H7 to H8);
- provision of passing places along Colwich Bridleway 19 and an access road from the bridleway to a balancing pond for railway drainage located within the Fradley to Colton area (CA1) (see Volume 2: Map CT-06-210, J6 to F7);
- two ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, within an area of grassland habitat creation, to the south of the route of the Proposed Scheme, 100m west of Moreton Grange Farm (see Volume 2: Map CT-06-210, F6 to E7);
- Moreton auto-transformer station, 46m by 24m, with an area of landscape mitigation planting, to the north of the route of the Proposed Scheme, 125m north of Moreton Grange Farm. Access will be provided from Bishton Lane, via the Colwich Bridleway 23 accommodation green overbridge and then south along a new access track (see Volume 2: Map CT-06-210, F5 to E5);
- a section of Moreton cutting, 1km in length and up to 19m in depth and 115m in width within this section, with an area of landscape mitigation planting and grassland habitat creation to the northern side of the route of the Proposed Scheme. Two noise fence barriers up to 3m in height, continuing from Moreton North embankment on the southern and northern sides of the cutting. The barrier to the south will provide acoustic screening for properties at Moreton Grange Farm. The barrier to the north of the cutting will provide acoustic screening for Moreton Farm (see Volume 2: Map CT-06-210, F5 to A6);
- widening of a 1.5km section of Bishton Lane to 3.5m in width, with provision of passing bays, from The Hollies to Colwich Bridleway 23, with replacement hedgerow planting on both sides of Bishton Lane (see Volume 2: Map CT-06-210, E10, CT-06-210 L1, G10 to F1, and CT-06-210 L2, H2 to G1);
- realignment of Colwich Bridleway 23, 260m in length and 35m west of its existing alignment, to cross over the route of the Proposed Scheme on the Colwich Bridleway 23 accommodation green overbridge, 2.6m above existing

ground level and 10m above rail level. This will increase the journey length travelling north via the Colwich Bridleway 19 by 235m, and reduce the journey length travelling south via the Colwich Bridleway 23 by 275m. The overbridge will also include planting to facilitate ecological connectivity across the route of the Proposed Scheme. Further detail regarding this overbridge is presented in Section 8, Ecology and biodiversity (see Volume 2: Map CT-06-210, F6 to E5);

- Moreton retaining wall, 208m in length and up to 10m in height, to the north of the route of the Proposed Scheme. This retaining wall will reduce the amount of land required for the Proposed Scheme in proximity to Moreton House (see Volume 2: Map CT-06-210, E5 to D5);
- one ecological mitigation pond, to provide replacement habitat for reptiles and amphibians, within an area of woodland habitat creation, on the west side of the route of the Proposed Scheme, 390m west of the Colwich Bridleway 23 accommodation green overbridge (see Volume 2: Map CT-06-210, C7 to A6);
- closure of Colwich Footpath 36 where it crosses the route of the Proposed Scheme with the retained sections diverted to form Colwich Footpath 36 (east) and Colwich Footpath 36 (west). Colwich Footpath 36 (east) will be diverted to join Colwich Bridleway 23, 400m south-east of its existing alignment, increasing the journey length by 140m. Colwich Footpath 36 (west) will be diverted 430m to the west to join Colwich Bridleway 35, increasing the journey length by 360m (see Volume 2: Map CT-06-210, E7 to A7);
- two ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, to the south of the route of the Proposed Scheme, within an area of grassland habitat creation, 30m south of the Colwich Bridleway 35 accommodation overbridge (see Volume 2: Map CT-06-210, C6 to A7); and
- realignment of Colwich Bridleway 35, to cross over the route of the Proposed Scheme via Colwich Bridleway 35 accommodation overbridge alongside its existing alignment. The overbridge will be 4.9m above existing ground level and 13m above rail level. The realignment of Colwich Bridleway 35 will increase the length of journey by 50m (see Volume 2: Map CT-06-210, A5 to A6).

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

2.2.13 Construction of this section will be managed from the Trent South embankment main compound and the Moreton auto-transformer station satellite compound. These compounds are described in Section 2.3, and shown on maps CT-05-210 and CT-05-212 in the Volume 2: CA2 Map Book.

2.2.14 Diversion of the Western Power Distribution 132kV overhead will be managed from the Moreton Brook viaduct satellite compound, located within the Fradley to Colton area (CA1) and shown on Map CT-05-209 in the Volume 2: CA1 Map Book.

Colwich Bridleway 35 accommodation overbridge to Mill Lane auto-transformer station

2.2.15 This section of the route of the Proposed Scheme will extend from Colwich Bridleway 35 accommodation overbridge to Mill Lane auto-transformer station. The route will continue in the Moreton cutting and then pass onto the Trent South embankment and the Great Haywood viaduct, followed by a short section of the route on the Trent North embankment.

2.2.16 This section of route is illustrated on maps CT-06-211 and CT-06-212 in the Volume 2: CA2 Map Book.

2.2.17 Key features of this 2.8km section will include:

- continuation of the Moreton cutting, 800m in length, up to 10m in depth and 73m in width within this section. A noise fence barrier, up to 2m in height, will be located at the northern end of the cutting to provide acoustic screening for properties on Tolldish Lane (see Volume 2: Map CT-06-211, H5 to E5);
- areas of woodland habitat creation and grassland habitat creation to the south of the Moreton cutting to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-211, H6 to G6);
- diversion of Colwich Footpath 26, 410m east of its existing alignment, to cross over the route of the Proposed Scheme on the Colwich Bridleway 35 accommodation overbridge, increasing the length of journey by 940m (see Volume 2: Map CT-06-211, H6 to F6);
- four ecological mitigation ponds to provide replacement habitat for reptiles and amphibians, one to the north of the route of the Proposed Scheme, 400m west of the Colwich Bridleway 35 accommodation overbridge, within an area of woodland habitat creation. There will be three ponds to the south of the route of the Proposed Scheme, within an area of grassland habitat creation, 525m west of the Colwich Bridleway 35 accommodation overbridge (see Volume 2: Map CT-06-211, F5 to E6);
- diversion of a National Grid 1,050mm diameter high pressure gas pipeline, for a distance of 400m, crossing the route of the Proposed Scheme 120m east of its existing alignment and 600m west of the Colwich Bridleway 35 accommodation overbridge (see Volume 2: Map CT-06-211, E6 to D5);
- Trent South embankment, 1.2km in length and up to 15m in height. Landscape earthworks, with mitigation planting, will provide visual screening for residents along Tolldish Lane and will help integrate the Proposed Scheme into the surrounding landscape. A noise fence barrier, up to 3m in height, continuing from Moreton cutting will be located along the northern side of the embankment to provide acoustic screening for properties on Tolldish Lane. One noise fence barrier to the south of the embankment and up to 5m in height to provide acoustic screening for properties in Great Haywood and Great Haywood Marina (see Volume 2: Map CT-06-211, D5 to CT-06-212, F6);

- an area of grassland habitat creation to the south-east of the Trent South embankment to provide replacement habitat and ecological connectivity between fragmented habitats (see Volume 2: Map CT-06-211, D7 to C6);
- an area of woodland habitat creation and grassland habitat creation, 225m to the south of the Trent South embankment, to provide replacement habitat and ecological connectivity between fragmented habitats (see Volume 2: Map CT-06-211, D7 to C8);
- diversion of a National Grid 12 inch diameter high pressure gas pipeline, for a distance of 550m, 100m east of its existing alignment. The pipeline will cross the route of the Proposed Scheme under the Trent South embankment, 50m east of the Colwich Bridleway 58 accommodation underbridge (see Volume 2: Map CT-06-211, C6 to A4);
- diversion of Colwich Footpath 54, 380m west of its existing alignment, to pass under the route of the Proposed Scheme in the Colwich Bridleway 58 accommodation underbridge. The diversion of Colwich Footpath 54 will reduce the length of journey by 55m (see Volume 2: Map CT-06-211, D7 to C3);
- diversion of Colwich Bridleway 58, 375m west of its existing alignment, to pass under the route of the Proposed Scheme in the Colwich Bridleway 58 accommodation underbridge. The diversion of Colwich Bridleway 58 will reduce the length of journey by 55m (see Volume 2: Map CT-06-211, D6 to B3);
- closure of Colwich Footpath 55 where it crosses the route of the Proposed Scheme, and the upgrade of a 210m section of the footpath, which will be reclassified as Colwich Bridleway 58. The footpath will be located 140m east of its existing alignment, to pass under the route of the Proposed Scheme in the Colwich Bridleway 58 accommodation underbridge. The closure and upgrading of Colwich Footpath 55 will reduce the length of journey to the north of Tolldish Lane by 120m, and extend the length of journey to the south of Tolldish Lane by 950m (see Volume 2: Map CT-06-211, C4 to B6);
- diversion of a British Pipeline Agency 10 inch diameter fuel pipeline, for a distance of 830m, 150m south-west of its existing alignment. The pipeline will be located 150m south-west of the Colwich Bridleway 58 accommodation underbridge (see Volume 2: Map CT-06-212, J8 to F8);
- diversion of Tolldish Lane to the north of the route of the Proposed Scheme to join the A51 Lichfield Road 250m north of the existing junction. The diverted section of Tolldish Lane will be in a cutting as it joins the A51 Lichfield Road. To the south of the route, a 200m section of Tolldish Lane will be retained for access to properties but closed to through-traffic (see Volume 2: Map CT-06-212, I5 to G6 and H7 to G8);
- Tolldish culvert, 50m south of the diverted Tolldish Lane, to convey an unnamed watercourse under the route of the Proposed Scheme (see Volume 2: Map CT-06-212, I6);

- A51 Lichfield Road underbridge to maintain vehicular and pedestrian access beneath the Trent North embankment (see Volume 2: Map CT-06-212, G6);
- a balancing pond for railway drainage, with an area of woodland habitat creation, to the south of the route of the Proposed Scheme, 75m south-west of the A51 Lichfield Road underbridge. Access will be provided from the A51 Lichfield Road via Main Road (see Volume 2: Map CT-06-212, G8 to F7);
- Great Haywood viaduct, 780m in length and up to 15.4m in height. Noise fence barriers will be located along the viaduct continuing from the Trent South embankment. A noise fence barrier on the southern side of the viaduct will be up to 4m in height to provide acoustic screening for properties in Great Haywood and Great Haywood Marina. A second noise fence barrier on the northern side of the viaduct, up to 3m in height, will provide acoustic screening for properties along Hoo Mill Lane (see Volume 2: Map CT-06-212, F6 to B6);
- modifications to the overhead line equipment on the Macclesfield to Colwich Line (see Volume 2: Map CT-06-212, F10 to E1);
- an area of wetland habitat creation, extending under the Great Haywood viaduct and alongside Great Haywood Marina to provide habitat connectivity to the south and north of the route of the Proposed Scheme (see Volume 2: Map CT-06-212, E7 to D3);
- a replacement floodplain storage area to the north of the route of the Proposed Scheme, within the area of wetland habitat creation, 10m south-east of Hoo Mill Lane. Following excavation, the area will be re-graded back to tie into existing ground level (see Volume 2: Map CT-06-212, D4);
- diversion of a National Grid 1,050mm high pressure gas pipeline, for a distance of 580m, 280m north-east of its existing alignment, north of the Great Haywood viaduct (see Volume 2: Map CT-06-212, D5 to B2);
- Hoo Mill Lane, a private accommodation track, will be diverted over a distance of 100m, 25m north of its existing alignment. The road will join Ingestre Park Road and provide access to properties along Hoo Mill Lane (see Volume 2: Map CT-06-212, C6 to B6);
- a balancing pond for railway drainage, within an area of woodland habitat creation, to the northern side of the route of the Proposed Scheme, 150m north of the diverted Hoo Mill Lane. Access will be provided from Ingestre Park Road (see Volume 2: Map CT-06-212, B6 to B4);
- Mill Lane auto-transformer station, 46m by 24m, to the northern side of the route of the Proposed Scheme, 20m to the west of Ingestre Park Road. Access will be provided from Ingestre Park Road (see Volume 2: Map CT-06-212, B6); and
- a section of Trent North embankment, 45m in length and up to 12m in height in this section. Landscape earthworks, with landscape mitigation planting, to provide visual screening for properties along Hoo Mill Lane and which will help integrate the Proposed Scheme into the surrounding landscape. A noise fence

barrier, up to 4m in height, will be located along northern side of the embankment, continuing on from the Great Haywood viaduct. The barrier will provide acoustic screening for properties along Hoo Mill Lane (see Volume 2: Map CT-06-212, B6 and B7).

2.2.18 This section of the route of the Proposed Scheme will include two emergency access points to the west of the Colwich Bridleway 35 accommodation overbridge. There will be two maintenance access points in this section of the Proposed Scheme to allow vehicle access to the route. There will be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

2.2.19 Construction of this section will be managed from the Trent South embankment main compound, the Trent North embankment satellite compound and Mill Lane auto-transformer station satellite compound. These compounds are described in Section 2.3 and shown on Map CT-05-212 in the Volume 2: CA2 Map Book.

Mill Lane auto-transformer station to Hanyards culvert

2.2.20 The route of the Proposed Scheme will continue from Mill Lane auto-transformer station to Hanyards culvert. In this section, the route will continue on Trent North embankment and will then proceed into Brancote South cutting, followed by a short section in the Brancote North cutting.

2.2.21 This section of route is illustrated on maps CT-06-213, CT-06-214 and CT-06-214-L1 in the Volume 2: CA2 Map Book.

2.2.22 Key features of this 2.7km section will include:

- continuation of the Trent North embankment, for 1.1km in length, and up to 11m in height in this section. Landscape earthworks, with landscape mitigation planting, will provide visual screening for the residents of Ingestre and Tixall, and will help integrate the Proposed Scheme into the surrounding landscape. A noise fence barrier, up to 4m in height, will be located along the northern side of the embankment, continuing on from the previous section. The barrier will provide acoustic screening for properties on Ingestre Park Road (see Volume 2: Map CT-06-213, J6 to D6);
- a balancing pond for railway drainage, within an area of woodland habitat creation, to the south of the route of the Proposed Scheme, 60m north-west of Great Haywood Road. Access will be provided from Great Haywood Road (see Volume 2: Map CT-06-213, I7 to I8);
- areas of woodland habitat creation on both sides of the Trent North embankment to provide replacement habitat and connectivity to existing habitats (see Volume 2: Map CT-06-213, H7 to C7 and F6 to F4);
- Lionlodge culvert, 570m west of Ingestre Park Road, to convey an unnamed watercourse under the route of the Proposed Scheme, (see Volume 2: Map CT-06-213, G6);

- areas of grassland habitat creation to the north of the Trent North embankment to provide replacement habitat and connectivity to existing habitats (see Volume 2: Map CT-06-213, E6 to A5);
- diversion of a British Pipeline Agency 10 inch diameter fuel pipeline, for a distance of 1.8km, 240m east of its existing alignment. The pipeline will cross the route of the Proposed Scheme under the Trent North embankment, 120m east of Ingestre underbridge (see Volume 2: Map CT-06-213, F7 to CT-06-214, F5);
- four ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, with areas of grassland habitat creation and woodland habitat creation, to the south-west of Ingestre underbridge on the southern side of the route of the Proposed Scheme (see Volume 2: CT-06-213, E7 to E8);
- Ingestre underbridge, with a restricted height clearance of 3.3m, to provide access to land to the south of the route of the Proposed Scheme (see Volume 2: Map CT-06-213, E6);
- Brancote South cutting, 1.6km in length, up to 17.1m in depth and 108m in width. A noise fence barrier, up to 4m in height, will continue from the Trent North embankment on the northern side of the cutting (see Volume 2: Map CT-06-213, D6 to CT-06-214, D6);
- a landscape bund[17], 490m in length and up to 3m in height above ground level, with woodland and grassland habitat creation on, and adjacent to, the bund to the north of the route of the Proposed Scheme. The bund, which will be located 375m south of Ingestre Hall, will provide visual screening for the residents of Ingestre. The woodland and grassland habitat creation areas will provide replacement habitat and ecological connectivity between fragmented habitats (see Volume 2: Map CT-06-213, D6 to A6);
- diversion of a National Grid 12 inch diameter high pressure gas pipeline, for a distance of 680m, 320m south of its existing alignment. The pipeline will cross the route of the Proposed Scheme 430m west of Ingestre underbridge (see Volume 2: Map CT-06-213, C5 to CT-06-214, H7);
- Ingestre green overbridge, which will be at existing ground level and 14m above rail level. This overbridge will facilitate ecological connectivity across the route of the Proposed Scheme. Further detail regarding this overbridge is presented in Section 7, Cultural heritage and Section 8, Ecology and biodiversity (see Volume 2: Map CT-06-214, J6 to I5);
- an area of woodland habitat creation to the south of the route of the Proposed Scheme, adjacent to Ingestre green overbridge, to provide replacement habitat and ecological connectivity between fragmented habitats (see Volume 2: Map CT-06-213, B7);

[17] A landscape bund is an earthworks structure designed to provide either visual screening or noise attenuation to receptors in proximity.

- two ecological mitigation ponds to provide replacement habitat for reptiles and amphibians, both within areas of grassland habitat creation, on the south and north side of the route of the Proposed Scheme, adjacent to Ingestre green overbridge (see Volume 2: Map CT-06-213, B7 and A5 to CT-06-214-J5 to G5);
- areas of woodland habitat creation to the south and north of the route of the Proposed Scheme to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-214, I6 to D6 and H5 to F5);
- an area of woodland habitat creation 350m north of the route of the Proposed Scheme to provide replacement habitat and ecological connectivity between fragmented habitats (see Volume 2: Map CT-06-214, E3 to C2);
- realignment of Tixall Bridleway 0.1628, 200m east of its existing alignment, to cross over the Tixall Bridleway 0.1628 accommodation overbridge. The overbridge will be up to 1m in height above existing ground level and 11m above rail level. The realignment of Tixall Bridleway 0.1628 will increase the length of journey by 340m (see Volume 2: Map CT-06-214, F7 to E6);
- diversion of Tixall Footpath 0.1630(b), 50m to the west of its existing alignment. It will join Tixall Bridleway 0.1628 to the north of the route of the Proposed Scheme and Hanyards Lane to the south of the route. The diverted footpath will cross over the route of the Proposed Scheme on the Tixall Bridleway 0.1628 accommodation overbridge. The diversion of Tixall Footpath 0.1630(b) will increase the length of journey by 90m. A 320m section of the retained Tixall Footpath 0.1630(b) to the south of the route will be upgraded and reclassified as Tixall Bridleway 0.1628 (see Volume 2: Map CT-06-214, G5 to E7);
- a section of Brancote North cutting, 60m in length, up to 4m in depth and 34m in width in this section (see Volume 2: Map CT-06-214, D6); and
- Hanyards culvert, 435m west of Tixall Bridleway 0.1628 accommodation overbridge, to provide surface water flow under the route of the Proposed Scheme (see Volume 2: Map CT-06-214, D6).

2.2.23 This section of the route of the Proposed Scheme will include four emergency access points, two to the east of Ingestre underbridge and two to the east of Tixall Bridleway 0.1628 accommodation overbridge. There will be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

2.2.24 Construction of this section will be managed from Trent North embankment satellite compound, Brancote South cutting satellite compound, and Hopton South cutting satellite compound, which are described in Section 2.3 and shown on maps CT-05-213 and CT-05-214 respectively.

Hanyards culvert to Sandon Road auto-transformer station

2.2.25 The route will continue from Hanyards culvert to Sandon Road auto-transformer station. The route of the Proposed Scheme in this section will be within Brancote North cutting for a short section continuing onto Hopton embankment. The route will then continue through Hopton South cutting and on to Hopton North cutting.

2.2.26 This section of route is illustrated on maps CT-06-214 to CT-06-216 in the Volume 2: CA2 Map Book.

2.2.27 Key features of this 3.2km section will include:

- continuation of the Brancote North cutting, for 480m in length, up to 3m in depth and 35m in width in this section (see Volume 2: Map CT-06-214, C6 to CT-06-215, I6);
- Hopton embankment, 460m in length and up to 8m in height. A noise fence barrier, up to 3m in height, will be located along the north side of the embankment. This barrier will provide acoustic screening for properties within Park Farm (see Volume 2: Map CT-06-215, I6 to F6);
- Berryhill (South) culvert, 175m east of Park Farm on Trent Walk, to convey an unnamed watercourse under the route of the Proposed Scheme (see Volume 2: Map CT-06-215, H6);
- an area of woodland habitat creation to the north of Hopton embankment to provide replacement habitat (see Volume 2: Map CT-06-215, H5 to G5);
- a balancing pond for railway drainage, within an area of grassland habitat creation, to the south of the route of the Proposed Scheme, 50m south of Trent Walk. Access will be provided from Trent Walk (see Volume 2: Map CT-06-215, G6);
- an area of woodland habitat creation 220m to the south of Hopton embankment to provide replacement habitat and ecological connectivity between fragmented habitats (see Volume 2: Map CT-06-215, G8 to G9);
- Trent Walk underbridge, with a restricted height clearance of 3.1m, to provide a restricted headroom access for agricultural use and access to residential properties along Trent Walk under the route of the Proposed Scheme. The underbridge will also provide a crossing point for an unnamed watercourse. Planting adjacent to this underbridge will facilitate ecological connectivity across the route of the Proposed Scheme. Further detail regarding this underbridge is presented in Section 8, Ecology and biodiversity (also see Volume 2: Map CT-06-215, F5 and F6);
- Hopton South cutting, 1.5km in length, up to 15m in depth and 91m in width (see Volume 2: Map CT-06-215, F6 to CT-06-216, F6);
- areas of woodland habitat creation to the south and north of the Hopton South cutting to provide replacement habitat (see Volume 2: Map CT-06-215, F5 to E8);

- the A518 Weston Road will be realigned over a distance of 750m, 30m west of its existing alignment. The road will be raised to cross the route of the Proposed Scheme on the A518 Weston Road overbridge, which will be 9m in height above both existing ground level and rail level. There will be landscape earthworks and landscape mitigation planting along both sides of the road on the southern approach to the A518 Weston Road overbridge (see Volume 2: Map CT-06-215, E9 to E4);
- two private means of access to Staffordshire County Showground and its adjacent overflow car park will be provided off the realigned A518 Weston Road on the northern side of the route of the Proposed Scheme, east and west of the A518 Weston Road overbridge (see Volume 2: Map CT-06-215, F5 to E5);
- Berryhill (North) drop inlet culvert[18], 25m west of the A518 Weston Road overbridge, for surface water flow under the route of the Proposed Scheme (see Volume 2: Map CT-06-215, D6);
- realignment of Hopton and Coton Footpath 24 over a distance of 175m, 30m east of its existing alignment, to cross over the route of the Proposed Scheme on the Hopton and Coton Footpath 24 accommodation overbridge, at existing ground level and 14m above rail level. The realignment of Hopton and Coton Footpath 24 will reduce the length of journey by 50m (see Volume 2: Map CT-06-215, C5 to B6);
- diversion of Hopton and Coton Footpath 6 over a distance of 710m, 440m east of its existing alignment, to cross over the route of the Proposed Scheme on the Hopton and Coton Footpath 24 accommodation overbridge and join Hopton and Coton Footpath 7 to the north of the route. The diversion of the Hopton and Coton Footpath 6 will increase the length of journey by 630m (see Volume 2: Map CT-06-215, A4 to A7);
- an area of woodland habitat creation to the south the Hopton South cutting, 50m south of the Hopton and Coton Footpath 24 accommodation overbridge, to provide replacement habitat (see Volume 2: Map CT-06-215, C6 and B6);
- areas of grassland creation to the north the Hopton South cutting, extending eastwards towards Hopton Pools, to provide replacement habitat and ecological connectivity between fragmented habitats (see Volume 2: Map CT-06-216, J3 to G5);
- noise fence barriers, up to 5m in height, will be located at the base of the northern side of Hopton South cutting, 125m west of Hopton and Coton Footpath 24 accommodation overbridge, continuing on to the Hopton North cutting. The barriers will provide acoustic screening for properties in Hopton (see Volume 2: Map CT-06-216, J5 to E5);

[18] 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.

- Hopton culvert, 575m west of the Hopton to Coton Footpath 24 accommodation overbridge, to convey an unnamed watercourse from Hopton Pools under the route of the Proposed Scheme (see Volume 2: Map CT-06-216, G6);
- a landscape bund, with landscape mitigation planting, 270m in length and up to 5m in height, on the north side of the route of the Proposed Scheme, 100m south of Hopton. The bund will provide visual screening for the residents of Hopton and will help integrate the Proposed Scheme into the surrounding landscape (see Volume 2: Map CT-06-216, I4 to F5);
- Hopton retaining wall, 300m in length and up to 4m in height, along the north side of the route of the Proposed Scheme, will create a false cutting[19], reducing the amount of land required in proximity to Hopton. A noise fence barrier, up to 3m in height, will be located on top of the retailing wall to provide acoustic screening for properties in Hopton (see Volume 2: Map CT-06-216, G6 to F5);
- a balancing pond for railway drainage, with an area of woodland habitat creation, to the south of the route of the Proposed Scheme. Access will be provided from the B5066 Sandon Road, Mount Edge and a new access track (see Volume 2: Map CT-06-216, H7 to G6);
- a landscape bund with woodland habitat creation, 260m in length and up to 4m in height above ground level, to the south of the route of the Proposed Scheme at Hopton. The bund will provide visual screening for residents of MoD Stafford and Mount Edge (see Volume 2: Map CT-06-216, G6 to F6);
- a section of Hopton North cutting, 730m in length, up to 16.2m in depth and 104m in width in this section. Noise fence barriers, up to 4m in height, will be located along the southern side of the route of the Proposed Scheme to provide acoustic screening at MOD Stafford. On the northern side of the route, a noise fence barrier, up to 5m in height, will continue from Hopton South cutting, along the foot of the Hopton North cutting (see Volume 2: Map CT-06-216, F6 to C5);
- an area of landscape mitigation planting to the north of Hopton North cutting to provide visual screening for properties at Hopton (see Volume 2: Map CT-06-216, F5 to E5);
- areas of woodland habitat creation to the south and north of the Hopton North cutting to provide replacement habitat and connectivity between fragmented and new habitats (see Volume 2: Map CT-06-216, F6 to C5);
- areas of grassland habitat creation to the south and north of the Hopton North cutting to provide replacement habitat and connectivity between fragmented and new habitats (see Volume 2: Map CT-06-216, F5 to E5, E7 to D6, D5 to C4);

[19] A means of screening a linear feature (e.g. a railway) by forming embankments on both sides of the feature.

- re-provision of pedestrian access across the route of the Proposed Scheme between Mount Edge and Hopton village, via the Hopton and Coton new footpath, 200m in length and over the Hopton and Coton new footpath overbridge, 1.7m above existing ground level and 9m above rail level. The overbridge will not be directly connected to the PRoW network, but will reinstate a connection between Mount Edge and Hopton Lane (see Volume 2: Map CT-06-216, D5 to D6);
- diversion of Hopton Lane over a distance of 550m, 400m west of its existing alignment, to join the B5066 Sandon Road, north of the route of the Proposed Scheme. This diversion will reduce the length of journey when travelling north on the B5066 Sandon Road by 200m, and increase the length of journey when travelling south on the B5066 Sandon Road by 300m (see Volume 2: Map CT-06-216, D5 to B5);
- a balancing pond for railway drainage, within an area of woodland habitat creation, to the southern side of the route of the Proposed Scheme, 20m north of Mount Edge. Access will be provided from Mount Edge and the B5066 Sandon Road (see Volume 2: Map CT-06-216, C7 to C6);
- a balancing pond for highway drainage, to the southern side of the route of the Proposed Scheme, 125m south-west of Mount Edge. Access will be provided from the B5066 Sandon Road via an access road from Mount Edge (see Volume 2: Map CT-06-216, C10); and
- Sandon Road auto-transformer station, 46m by 24m, on the southern side of the route of the Proposed Scheme, 425m north-west of the Hopton and Coton new footpath overbridge. Access will be provided from Mount Edge and the B5066 Sandon Road (see Volume 2: Map CT-06-216, C6).

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

2.2.29 Construction of this section will be managed from the Hopton South cutting satellite compound, Hopton North cutting satellite compound and from the Sandon Road auto-transformer station satellite compound. These compounds are described in Section 2.3 and shown on maps CT-05-215 and CT-05-216 in the Volume 2: CA2 Map Book.

Sandon Road auto-transformer station to Marston Lane underbridge

2.2.30 The route of the Proposed Scheme will continue from Sandon Road auto-transformer station to Marston Lane underbridge in Hopton North cutting for 1.4km, continuing on the Marston South embankment past Marston.

2.2.31 This section of route is illustrated on maps CT-06-216 to CT-06-218 in the Volume 2: CA2 Map Book.

2.2.32 Key features of this 2km section will include:

- continuation of the Hopton North cutting, for 1.4km in length, up to 13m in depth and 93m in width in this section. A noise fence barrier, up to 4m in height, will continue on the southern side of the route of the Proposed Scheme along the foot of the cutting to provide acoustic screening for properties in Hopton (see Volume 2: Map CT-06-216, C5 to A5 and CT-06-217, J5 to D5);
- realignment of the B5066 Sandon Road, 1km in length and 100m north-west of its existing alignment, to cross the route of the Proposed Scheme on the B5066 Sandon Road overbridge, 10m above existing ground level. This will reduce the journey length by 30m. Landscape earthworks, with landscape mitigation planting on both sides of the road, will help integrate the Proposed Scheme into the surrounding landscape. There will also be an area of woodland habitat creation along the south-east of the realigned road to provide replacement habitat (see Volume 2: Map CT-06-216, B2 to B10);
- the southern extent of Mount Edge will be diverted over a distance of 225m, 125m south-west of its existing alignment. A new section of road, 240m in length will reconnect the realigned B5066 Sandon Road with Mount Edge. The road will join the realigned B5066 Sandon Road to the south of the route of the Proposed Scheme and will reduce the length of journey by 175m (see Volume 2: Map CT-06-216, D7 to B8);
- Sandon Road drop inlet culvert, 50m south-east of the B5066 Sandon Road overbridge, for surface water flow under the route of the Proposed Scheme (see Volume 2: Map CT-06-216, B5);
- a balancing pond for highway drainage, on the northern side of the route of the Proposed Scheme, 150m north-east of the B5066 Sandon Road overbridge. Access will be provided from the realigned B5066 Sandon Road and the Hopton and Coton Bridleway 12 (see Volume 2: Map CT-06-216, B4);
- an area of grassland habitat creation planting to the north-east of the B5066 Sandon Road overbridge to provide replacement habitat (see Volume 2: Map CT-06-216, B2 to A1);
- an area of landscape mitigation planting on the northern side of the Hopton North cutting, 400m north-west of the B5066 Sandon Road overbridge, to provide visual screening for residents of Kents Barn Farm, and an area of grassland habitat creation to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-217, G5 and E5);
- realignment of the Hopton and Coton Bridleway 11, 25m east of its existing alignment, to cross over the route of the Proposed Scheme via the Hopton and Coton Bridleway 11 accommodation overbridge. The overbridge will be 3.8m above existing ground level and 9m above rail level. The realignment of the Hopton and Coton Bridleway 11 will reduce the length of journey by 12m (see Volume 2: Map CT-06-217, F7 to E5);
- diversion of a British Pipeline Agency 10 inch diameter fuel pipeline, for a distance of 815m, 370m north of its existing alignment. The pipeline will cross the route of the Proposed Scheme under the Hopton North cutting, 250m

north-west of the Hopton and Coton Bridleway 11 accommodation overbridge (see Volume 2: Map CT-06-217, G5 to D7);

- diversion of the Hopton and Coton Bridleway 12, 150m north of its existing alignment, to join the Hopton and Coton Bridleway 11 on the northern side of the route. This diversion will reduce the length of journey travelling north by 135m. Travelling south, to cross the route of the Proposed Scheme via the Hopton and Coton Bridleway 11 accommodation overbridge, will extend the length of journey by 190m (see Volume 2: Map CT-06-217, F5 to E5);
- diversion of the Hopton and Coton Bridleway 16, 165m south of its existing alignment, to join the Hopton and Coton Bridleway 11 on the southern side of the route. This diversion will reduce the length of journey travelling south by 65m. Travelling north, to cross the route of the Proposed Scheme via the Hopton and Coton Bridleway 11 accommodation overbridge, will extend the length of journey by 200m (see Volume 2: Map CT-06-217, E6 to D5);
- an area of landscape mitigation planting on the southern side of the Hopton North cutting, 100m north-west of the Hopton and Coton Bridleway 11 accommodation overbridge, to provide visual screening for residents of Newbuildings Cottage (see Volume 2: Map CT-06-217, E6 and D6);
- a section of Marston South embankment, 640m in length and up to 10m in height in this section. Two noise fence barriers, 3m in height, will be located along the embankment. The barrier to the north will provide acoustic screening for properties on Marston Lane, to the north-east of the route. The barrier to the south of the embankment will provide acoustic screening to properties on Marston Lane and Yarlet Lane to the south of the route (see Volume 2: Map CT-06-217, C5 to CT-06-218, F5);
- an area of grassland habitat creation to the southern side of the route of the Proposed Scheme, adjacent to Marston Bridleway 8, to provide replacement habitat around existing ponds and ecological connectivity to surrounding habitats (see Volume 2: Map CT-06-217, D6 to B6);
- diversion of a National Grid 1,050mm diameter high pressure gas pipeline, for a distance of 280m, crossing the route of the Proposed Scheme 55m north of its existing alignment and 375m north-west of the Hopton and Coton Bridleway 11 accommodation overbridge (see Volume 2: Map CT-06-217, D5 to C6);
- realignment of Marston Bridleway 8, 145m in length and 15m north of its existing alignment, to pass under the route of the Proposed Scheme via Marston Bridleway 8 accommodation underbridge. The realignment will extend the length of journey by 10m (see Volume 2: Map CT-06-217, B6 to B5);
- a balancing pond for railway drainage, to the northern side of the route of the Proposed Scheme, 30m east of the Marston Bridleway 8 accommodation underbridge. Access will be provided from Marston Lane (see Volume 2: Map CT-06-217, B5);

- one ecological mitigation pond to provide replacement habitat for reptiles and amphibians, within an area of grassland habitat creation, on the northern side of the route of the Proposed Scheme, adjacent to Marston Lane and 350m north-east of the Marston Bridleway 8 accommodation underbridge (see Volume 2: Map CT-06-217, B2 to B3);
- realignment of Marston Lane, with provision of passing bays, 800m in length and 200m north of its existing alignment to pass under the route of the Proposed Scheme via the Marston Lane underbridge. There will be no change to the length of journey (see Volume 2: Map CT-06-218, J2 to H6);
- an area of landscape mitigation planting to the southern side of the route of the Proposed Scheme, between the Marston Bridleway 8 accommodation underbridge and the Marston Lane underbridge, to provide visual screening for properties on Marston Lane, to the south of the route (see Volume 2: Map CT-06-218, I6 to H5); and
- a balancing pond for railway drainage on the northern side of the route of the Proposed Scheme, within an area of grassland habitat creation, adjacent to the realigned Marston Road and 25m north-east of the Marston Lane underbridge. Access will be provided from the realigned Marston Lane (see Volume 2: Map CT-06-218, I4 to H5).

2.2.33 This section of the route of the Proposed Scheme will include one emergency access point to the east of the B5066 Sandon Road overbridge, and one maintenance access point to allow vehicle access to the route. There will be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

2.2.34 Construction of this section will be managed from the Hopton North cutting satellite compound and the Marston South embankment satellite compound, which are described in Section 2.3 and shown on maps CT-05-217 and CT-05-218 in the Volume 2: CA2 Map Book.

Marston Lane underbridge to Yarlet

2.2.35 The route will continue from Marston Lane underbridge, initially on the Marston South embankment, continuing on to the Marston North embankment into Yarlet South cutting, past Yarlet and underneath the A34 Stone Road. The northern boundary of the Colwich to Yarlet area ends at the boundary with the Stone and Swynnerton area (CA3), 1km north-west of Yarlet.

2.2.36 This section of route is illustrated on maps CT-06-218 and CT-06-219a in the Volume 2: CA2 Map Book.

2.2.37 Key features of this 2.7km section will include:

- continuation of the Marston South embankment, 430m in length and up to 7m in height within this section. A noise fence barrier, continuing from the previous section, will be located along the southern side of the embankment to provide acoustic screening for properties on Marston Lane and Yarlet Lane. A

landscape bund, approximately 270m in length and up to 5m in height above ground level, with landscape mitigation planting will provide acoustic and visual screening for residents of properties along Marston Lane on the southern side of the route of the Proposed Scheme. There will also be an area of woodland habitat creation to provide replacement habitat and ecological connectivity along the southern side of the route (see Volume 2: Map CT-06-218, H5 to F5);

- areas of grassland habitat creation around existing ponds on the southern side of the Marston South embankment to provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-218, H7 to G8);
- one ecological mitigation pond to provide replacement habitat for reptiles and amphibians, within an area of grassland habitat creation, on the southern side of the route of the Proposed Scheme, adjacent to Yarlet Lane and 250m north-west of the Marston Lane underbridge (see Volume 2: Map CT-06-218, G6 to F6);
- diversion of Marston Footpath 2, 375m in length and 280m south-east of its existing alignment, to pass under the route of the Proposed Scheme via Marston Lane underbridge, connecting it to the realigned Marston Lane. The diversion will extend the length of journey by 415m (see Volume 2: Map CT-06-218, H5 to G5);
- Marston North embankment, 1km in length and up to 4m in height. There will be two landscape bunds, up to 5m in height, with landscape mitigation planting and woodland habitat creation on the southern side of the route of the Proposed Scheme. The first bund, approximately 170m in length, continuing on from along Marston South embankment, and the second bund, approximately 590m in length. These bunds will provide acoustic and visual screening for residents along Yarlet Lane, and replacement habitat and ecological connectivity. Two noise fence barriers, 3m in height, will be located along the southern side of the embankment, one to provide acoustic screening for Park Farm, Marston, and the second to provide acoustic screening for properties at the western end of Yarlet Lane, on the southern side of the route. (see Volume 2: Map CT-06-218, F5 to CT-06-219a, H6);
- two ecological mitigation ponds, 625m north-west of the Marston Lane underbridge, to provide replacement habitat for reptiles and amphibians, on the northern side of the route of the Proposed Scheme, within an area of grassland habitat creation. The grassland habitat creation will extend for 800m along the northern side of the Marston North embankment (see Volume 2: Map CT-06-218, G5 to D3);
- a balancing pond for railway drainage, within an area of grassland habitat creation, on the northern side of the route of the Proposed Scheme, 175m north of Marston House Barns on Yarlet Lane, with access from the realigned Marston Lane (see Volume 2: Map CT-06-218, H4 to A5);
- an area of woodland habitat creation and grassland habitat creation to the southern side of the route of the Proposed Scheme, adjacent to Yarlet Lane, to

provide replacement habitat and ecological connectivity (see Volume 2: Map CT-06-218, B7 to A6 and Map CT-06-219a, I6 to G8);

- Yarlet Wood drop inlet culvert, 240m south-east of the A34 Stone Road, to convey an unnamed watercourse under the route of the Proposed Scheme (see Volume 2: Map CT-06-219a, H5);
- Yarlet South cutting, 1.3km in length, up to 21m in depth and 122m in width. A noise fence barrier, 3m in height, will continue from Marston North embankment on the southern side of the route of the Proposed Scheme to provide acoustic screening for properties at the western end of Yarlet Lane. A second noise fence barrier, also 3m in height will be located along the northern side of the route, west of the A34 Stone Road to provide acoustic screening for properties along the A34 Stone Road and Yarlet School (see Volume 2: Map CT-06-219a, H5 to B5);
- areas of woodland habitat creation to the southern and northern sides of the route of the Proposed Scheme, adjacent to Yarlet Wood, to provide replacement habitat and ecological connectivity between fragmented habitats (see Volume 2: Map CT-06-219a, H6 to G5);
- areas of grassland habitat creation on the northern side of the Proposed Scheme to provide replacement habitat and ecological connectivity between fragmented habitats, extending 575m to the south-east, south of the A34 Stone Road (see Volume 2: Map CT-06-219a, I2 to F5);
- two ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, on the northern side of the route of the Proposed Scheme, within an area of grassland habitat creation, 100m east of the A34 Stone Road (see Volume 2: Map CT-06-219a, G4 to F5);
- the A34 Stone Road will be reinstated, on its current alignment, to cross the route of the Proposed Scheme at existing ground level via the A34 Stone Road overbridge, 11m above rail level (see Volume 2: Map CT-06-219a, F6 to E4);
- two ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, within an area of grassland habitat creation, on the southern side of the route of the Proposed Scheme, 200m west of the A34 Stone Road overbridge (see Volume 2: Map CT-06-219a, E6 to D7);
- Yarlet express feeder auto-transformer station, 90m by 45m, within an area of woodland habitat creation and grassland habitat creation, to the northern side of the route of the Proposed Scheme, 225m north-west of the A34 Stone Road overbridge. Access will be provided from the A34 Stone Road, (see Volume 2: Map CT-06-219a, F5 to D5);
- Yarlet Bank drop inlet culvert, 325m north-west of the A34 Stone Road overbridge, for surface water flow under the route of the Proposed Scheme (see Volume 2: Map CT-06-219a, D5);
- one ecological mitigation pond, to provide replacement habitat for reptiles and amphibians, within an area of grassland habitat creation, to the northern

side of the route of the Proposed Scheme, 625m north-west of the A34 Stone Road overbridge (see Volume 2: Map CT-06-219a, C5 to B4);

- two ecological mitigation ponds, to provide replacement habitat for reptiles and amphibians, within an area of grassland habitat creation, to the southern side of the route of the Proposed Scheme, 725m north-west of the A34 Stone Road overbridge (see Volume 2: Map CT-06-219a, D6 to B7); and
- Peasley Bank drop inlet culvert, 750m north-west of the A34 Stone Road overbridge, for surface water flow under the route of the Proposed Scheme (see Volume 2: Map CT-06-219a, B5 to B6).

2.2.38 This section of the route of the Proposed Scheme will include one emergency access point to the east of Marston Lane underbridge and three maintenance access points to allow vehicle access to the route. There will be maintenance access routes and hedgerow planting throughout this section. There will also be minor utilities works within this section, which may include works to low voltage overhead or underground lines, gas pipes, sewers and telecommunication cables.

2.2.39 Construction of this section will be managed from the Marston South satellite compound, the Marston North embankment satellite compound, the Yarlet South cutting satellite compound, and the Yarlet express feeder auto-transformer station railway systems compound. These compounds are described in Section 2.3 and shown on Map CT-05-218 and Map CT-05-219a in the Volume 2: CA2 Map Book.

Demolitions

2.2.40 Demolition of 15 residential properties, 20 commercial and business properties (including farm outbuildings), and 11 other buildings/structures will be required to construct the permanent features in the Colwich to Yarlet area. Demolitions will be managed from the same construction compounds as the permanent features with which they are associated. The identified demolitions are listed in Section 2.3 under the relevant construction compounds.

2.3 Construction of the Proposed Scheme

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

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

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

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

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

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

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

Code of Construction Practice

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

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

Overview of the construction process

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

- advance works including site investigations further to those already undertaken, and preliminary mitigation works;
- civil engineering works including: establishment of construction compounds; site haul routes, site preparation and enabling works; main earthworks and structure works; removal of construction compounds and site restoration where the compound is not required for railway installation works; and associated utility diversions;
- railway installation works including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the

existing rail network; and removal of construction compounds and site restoration;

- site finalisation works; and
- systems testing and commissioning.

2.3.10 General information about the construction process is set out in more detail in Volume 1, Section 6, and the following sections of the draft CoCP (see Volume 5: Appendix CT-003-000) including:

- the approach to environmental management during construction and the role of the CoCP (Section 2);
- working hours (Section 5);
- management of construction traffic (Section 14); and
- handling of construction materials (Section 15).

Advance works

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

- further detailed site investigations and surveys
- further detailed environmental surveys; and
- advance mitigation works including, where appropriate, contamination remediation, habitat creation and translocation, landscape planting and built heritage survey and investigation.
- advance site access works; and
- site establishment with temporary fence construction; along with soil stripping and vegetation removal.

Engineering works

Introduction

2.3.12 Construction of the Proposed Scheme will require the following broad types of engineering works along the entire length of the route, and within land adjacent to the route:

- civil engineering works, including earthworks such as embankments and cuttings, erection of bridges and viaducts and works to public roads; and
- works to install, test and commission railway systems, including track, overhead line equipment, communications and signalling equipment and traction power supply.

2.3.13 The construction of track and railway systems works in open areas will include the installation of track form, rails, infill material, minor drainage works, and installation of electrification, signalling and communication equipment.

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

2.3.15 One main civil engineering compound and seven civil engineering satellite compounds will be located within the Colwich to Yarlet area, one of which will continue to be used as a satellite compound for railway systems works on completion of civil engineering works. There will also be an additional three satellite compounds which will be used for railway systems works only.

2.3.16 The main civil engineering compound in this area will manage the seven satellite compounds, as well as nine satellite compounds located in the Fradley to Colton area (CA1).

2.3.17 Satellite compounds, for railway systems works, will be managed from the Stone railhead main compound located in the Stone to Swynnerton area (CA3) (see Volume 2: CA3 Map Book: Map CT-05-223, J9 to C7).

2.3.18 Figure 4 shows the management relationship for civil engineering works compounds and Figure 5 for the railway installation works. Details about the works associated with individual compounds are provided in subsequent sections of this report.

2.3.19 Figure 6 provides a programme of works which will be managed from each construction compound. All dates and durations of activities set out in this section are indicative.

General overview of construction compounds

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

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

2.3.21 In the Colwich to Yarlet area there will be accommodation at the Trent South embankment main compound for the construction workforce. Details of the location

and duration of worker accommodation are provided in the description of the compound.

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

2.3.23 The storage of soil, stripped as part of the works prior to it being re-used when the land is reinstated, requires land for the duration of construction. The location of soil storage areas will generally be adjacent to compounds and areas of construction activity. These areas are referred to as material stockpiles and those adjacent to compounds are shown on maps CT-05-210 to CT-05-219a in the Volume 2: CA2 Map Book.

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

Construction traffic routes, site haul routes and transfer nodes

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

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

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

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

2.3.29 Areas of land are also required for the storage, loading and unloading of bulk earthworks materials that are moved to and from the site on public roads. These will allow transfer of material between road vehicles and site vehicles during construction to balance traffic movements on the road network. These areas are referred to as transfer nodes and are shown on maps CT-05-212, CT-05-215 and CT-05-219a in the Volume 2: CA2 Map Book.

Use of borrow pits

2.3.30 A borrow pit is an area where material, usually sand and gravel, is excavated for use in the construction of nearby infrastructure projects. There are no borrow pits proposed in the Colwich to Yarlet area, however material from borrow pits in neighbouring community areas may be used for construction of earthworks within the Colwich to Yarlet area, if required. Excavated material may be used to backfill or restore borrow pits. Where reasonably practicable, this material will be transported via site haul routes.

Figure 4: Construction compounds showing key civil engineering works within the Colwich to Yarlet area

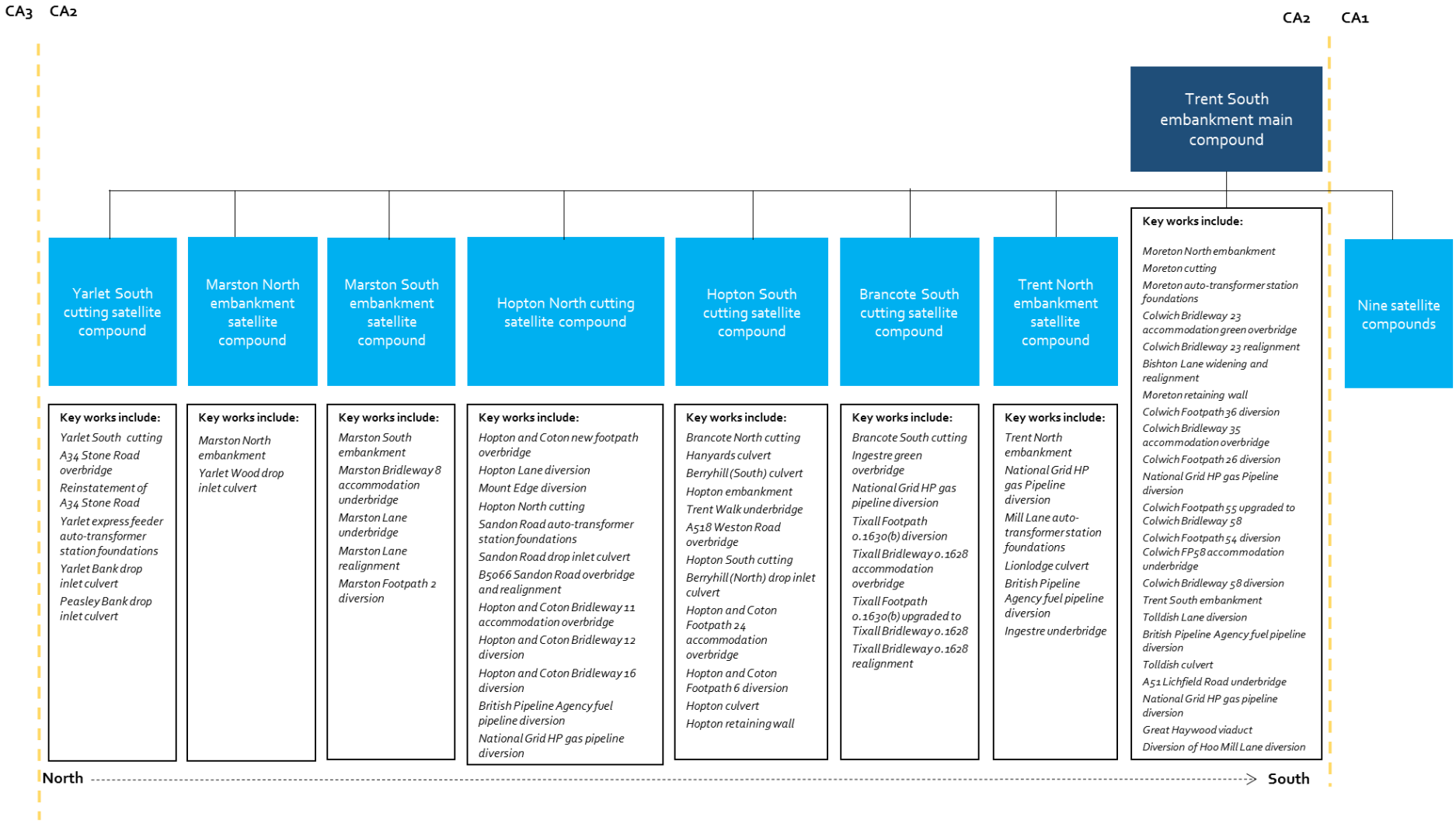
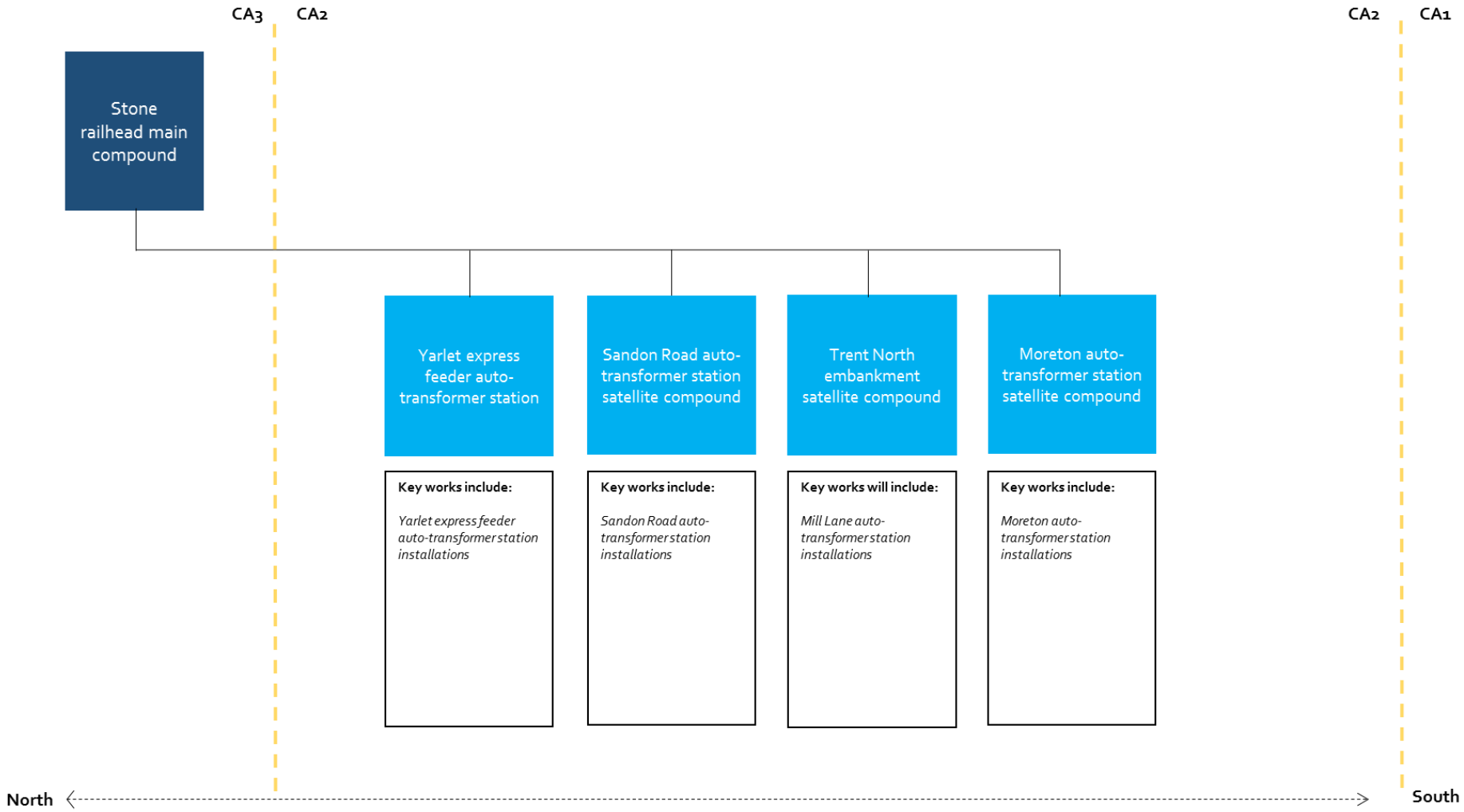


Figure 5: Construction compounds for railway installation works showing key works within the Colwich to Yarlet area



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

Trent South embankment main compound

2.3.32 This compound will provide for civil engineering works and railway system works and will support the seven civil satellite compounds in the Colwich to Yarlet area (CA2) and nine civil satellite compounds in the Fradley to Colton area (CA1) (shown on map CT-05-212, F3). The main compound will:

- be operational for six years, commencing during 2021, from which civil engineering works will be managed;
- support 250 civil engineering workers per day (350 workers at peak times);
- provide temporary worker accommodation for 240 workers (see Volume 2: Map CT-05-212, F2 to F3), including welfare facilities and parking, for six years;
- provide two transfer nodes, accessed from the A51 Lichfield Road (Volume 2: Map CT-05-212, I5 to G4 and G4 to F5) for the storage and loading and unloading of bulk earthworks materials, which will be moved to and from the compound on public roads, for four years and three months;
- provide 10 temporary material stockpiles to the southern and northern sides of the route of the Proposed Scheme (see Volume 2: Map CT-05-210, G6, D6, B6, CT-05-211, H5, G6, F6, F5, C7 and C5); and
- be accessed via the A51 Lichfield Road, 250m north from where the A51 Lichfield Road will cross the route of the Proposed Scheme (see Volume 2: Map CT-05-212, G4).

2.3.33 The works to be managed from this compound will require the demolition of buildings and structures, as detailed in Table 1.

Table 1: Demolitions to be managed from the Trent South embankment main compound

Description	Location	Feature resulting in the demolition
Residential		
Two-storey farmhouse	Tithe Barn Farm, Tolldish Lane	Moreton cutting
Two-storey residential property	Avondale, Tolldish Lane	Trent South embankment
Commercial		
Two single-storey barn/farm storage and one two-storey barn	Tithe Barn Farm, Tolldish Lane	Moreton cutting
Two-storey barn	Avondale, Tolldish Lane	Trent South embankment
Single-storey barn	Between the A51 Lichfield Road and Macclesfield to Colwich Line, north of Tolldish Lane	Trent South embankment

Description	Location	Feature resulting in the demolition
Other		
Single storey outbuilding	Tolldish Lane	Trent South embankment
Two outbuildings	Tithe Barn Farm, Tolldish Lane	Moreton cutting
Wind turbine	Moreton House Farm	Moreton cutting
One single storey outbuilding (garage associated with Avondale)	Avondale, Tolldish Lane	Trent South embankment

2.3.34 The compound will be used to manage the construction of the following bridges and viaducts:

- Colwich Bridleway 23 accommodation green overbridge, which will take one year and six months to complete;
- Colwich Bridleway 35 accommodation overbridge, which will take one year and six months to complete;
- Colwich Footpath 58 accommodation underbridge, which will take nine months to complete;
- A51 Lichfield Road underbridge, which will take two years and three months to complete; and
- Great Haywood viaduct, which will take three years and three months to complete.

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

- Moreton North embankment, which will take two years and nine months to complete;
- Moreton cutting, which will take two years and nine months to complete; and
- Trent South embankment, which will take two years and nine months to complete.

2.3.36 Material for the Moreton North embankment and Trent South embankment will be received from Moreton cutting, from cuttings elsewhere along the Proposed Scheme and/or from borrow pits.

2.3.37 In addition, the compound will be used to manage the construction of the Moreton retaining wall, which will take six months to complete.

2.3.38 A temporary concrete batching plant and asphalt batching plant will be located within the compound which will provide concrete and asphalt supply to the construction works across the Proposed Scheme and will be operational for four years and three months (see Volume 2: Map CT-05-212, G4 to F6).

2.3.39 A viaduct launching yard, from which pre-cast elements for the Great Haywood viaduct will be installed, will be located at the compound for a period of three years and three months (see Volume 2: Map CT-05-212, G6 to F6).

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

- widening of a 1.5km section of Bishton Lane to 3.5m in width, with vehicle passing places, to allow maintenance access. Works will take place from The Hollies (280m south of WCML) to Colwich Bridleway 23, which will take nine months to complete;
- temporary diversion of Tolldish Lane, 500m in length, will be constructed offline[20], over a period of nine months, to the north of the route of the Proposed Scheme to join the A51 Lichfield Road, 400m north of the existing junction. Tolldish Lane will remain open during the construction of the Tolldish Lane temporary diversion to allow access to be maintained to properties to the north of the Proposed Scheme during construction. Following completion, Tolldish Lane will be permanently diverted to the north of the route for 450m to join the A51 Lichfield Road, 250m north of its existing alignment. To the south of the route, a 200m section of Tolldish Lane will be retained for access to properties but closed to through-traffic. This will take six months to complete;
- a temporary roundabout will be constructed at the junction of the Tolldish Lane temporary diversion, the A51 Lichfield Road and a site haul route, which will be in place for four years. Construction of the temporary roundabout will require intermittent lane restrictions on the A51 Lichfield Road over a three month period;
- the A51 Lichfield Road will be permanently lowered for 300m and diverted beneath the Proposed Scheme via the A51 Lichfield Road underbridge, which will take two years and three months to complete. The A51 Lichfield Road will remain open during the construction of the Trent South embankment. Lane restrictions and overnight and weekend closures will be required to allow connection of the new road with the existing alignment will be required during the construction period;
- a temporary roundabout will be constructed at the junction of Hoo Mill Lane, Ingestre Park Road, Great Haywood Road, and Mill Lane and connect to a site haul route. This temporary roundabout will be in place for four years and three months. Hoo Mill Lane, Ingestre Park Road, Great Haywood Road and Mill Lane will remain open during the construction of the Great Haywood viaduct. A number of lane restrictions, overnight and weekend closures will be required during the construction period. There will also be works to Great Haywood Road at Tixall. These are described and assessed in Volume 4, Off-route effects; and
- a 100m section of the Hoo Mill Lane private accommodation track will be permanently diverted 25m north of its existing alignment, to join Ingestre Park Road. Hoo Mill Lane will remain open during the construction of the

[20] Offline works are works which are generally constructed along or nearby the existing routes, which will remain open during construction.

permanent diversion, which will take six months to complete, and will require lane closures and traffic management on Ingestre Park Road.

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

- temporary diversion of Colwich Bridleway 23, for 150m to join Bishton Lane, 40m south of its existing alignment during construction of the Colwich Bridleway 23 accommodation green overbridge and earthworks. Following construction, there will be a permanent realignment of 260m of Colwich Bridleway 23 to the north via the Colwich Bridleway 23 accommodation green overbridge;
- closure of Colwich Footpath 36 where it crosses the route of the Proposed Scheme with the retained sections being permanently diverted to form Colwich Footpath 36 (east) and Colwich Footpath 36 (west). Colwich Footpath 36 (east) will be diverted to join Bishton Lane, 400m south-east of its existing alignment. Colwich Footpath 36 (west) will be diverted 430m to the west to join Colwich Bridleway 35;
- temporary diversion of Colwich Bridleway 35, for 325m, 30m south of its existing alignment during construction of the Colwich Bridleway 35 accommodation overbridge. On completion of construction, a 225m section of the Colwich Bridleway 35 will be permanently realigned via the Colwich Bridleway 35 accommodation overbridge on its existing alignment;
- temporary diversion of Colwich Footpath 26 to the east, for 550m to join Colwich Bridleway 35, for a period of three years. On completion of construction, a 500m section of the Colwich Footpath 26, 500m in length, will join Colwich Bridleway 35 to the north of the accommodation overbridge, 410m south of its existing alignment. A 650m section of the Colwich Footpath 26 will join Colwich Bridleway 35 to the south of the accommodation overbridge;
- permanent diversion of Colwich Footpath 54 and the diversion of Colwich Bridleway 58, 375m west of the existing alignment to pass under the route of the Proposed Scheme in the Colwich Bridleway 58 accommodation underbridge;
- closure of a 280m section of Colwich Footpath 55 where it crosses the route of the Proposed Scheme, and the permanent upgrade of a 210m section of the footpath, which will be reclassified as Colwich Bridleway 58. The footpath will be located 140m east of its existing alignment, to pass under the route of the Proposed Scheme in the Colwich Bridleway 58 accommodation underbridge;
- permanent diversion of the Colwich Bridleway 58, 380m west of its existing alignment, where it currently terminates and continues north as a Colwich Footpath 54, via the Colwich Bridleway 58 accommodation underbridge; and
- two temporary local diversions of Colwich Footpath 63 for a period of one year and six months. The first diversion will be 150m in length, located 150m north

of the Great Haywood viaduct, diverting the footpath 40m west of its existing alignment around a temporary bridge to enable the site haul route to cross the Trent and Mersey Canal. The second will pass under the Great Haywood viaduct, diverting the footpath 40m west of its existing alignment.

2.3.42 The compound will be used to manage the construction of Tolldish culvert to convey an unnamed watercourse under the route of the Proposed Scheme, which will take nine months to complete.

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

- diversion of a National Grid Gas Transmission 1,050mm diameter high pressure gas pipeline for a distance of 400m, 120m east of its existing alignment, which will take nine months to complete;
- diversion of a National Grid Gas Distribution 12 inch diameter high pressure gas pipeline for a distance of 550m, 100m east of its existing alignment, which will take nine months to complete; and
- diversion of a British Pipeline Agency 10 inch diameter fuel pipeline for a distance of 830m, 150m south-west of existing alignment which will take nine months to complete.

2.3.44 This compound will manage the construction of the Moreton auto-transformer station foundations and building, which will take six months to complete.

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

Moreton auto-transformer satellite compound

2.3.46 This compound will provide for the installation of railway systems equipment at Moreton auto-transformer station (see Volume 2: Map CT-05-210, F5) and will:

- be operational for one year and three months, commencing during 2024;
- support 30 railway installation workers per day (40 workers at peak times);
- be accessed via a new access road off Bishton Lane; and
- be managed from the Stone railhead main compound in the Stone and Swynnerton area (CA3).

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

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

2.3.49 Other works that will be managed from this compound include site clearance, enabling works, and finalisation works including site reinstatement, fencing, planting, and landscaping.

Trent North embankment satellite compound

2.3.50 This compound will provide for civil engineering and railway systems works (see Volume 2: Map CT-05-212, C5 to B6) and will:

- be operational for five years, commencing during 2021. Civil engineering works will be managed from this compound the first three years and nine months. After the civil engineering works are complete, this compound will reduce in size and be used to manage railway systems works for a period of one year and three months;
- support 25 civil engineering workers per day (35 workers at peak times);
- support 30 railway systems workers per day (40 workers at peak times);
- provide three temporary materials stockpiles to the northern and southern sides of the Proposed Scheme (see Volume 2: Map CT-05-213, H7 and G7, I8 to G8 and F6 to F4); and
- be accessed primarily via Great Haywood Road, and via Mill Lane as a secondary access, during civil engineering works and via Ingestre Park Road and Hoo Mill Lane during railway systems works.

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

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

2.3.53 The compound will be used to manage the construction of the Ingestre underbridge, which will take one year to complete.

2.3.54 The compound will be used to manage construction of the Trent North embankment, which will take two years and three months to complete. Material for the Trent North embankment will be received from cuttings in the Colwich to Yarlet area, from elsewhere along the Proposed Scheme and/or from borrow pits.

2.3.55 The compound will be used to manage the construction of Lionlodge culvert to convey an unnamed watercourse under the route of the Proposed Scheme, which will take nine months to complete.

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

- diversion of a National Grid Gas Transmission 1,050mm diameter high pressure gas pipeline for a distance of 580m, 280m north-east of its existing alignment, north of Great Haywood viaduct, which will take nine months to complete; and
- diversion of a British Pipeline Agency 10 inch diameter fuel pipeline for a distance of 1.8km, 240m east of its existing alignment, which will take nine months to complete.

2.3.57 The compound will be used to manage the construction of the Mill Lane auto-transformer station. Civil engineering works to construct the foundations will take six months to complete and installation of the railway systems equipment associated with the Mill Lane auto-transformer station will take a further one year and three months to complete. A new access road will be provided from Ingestre Park Road via Mill Lane and Great Haywood Road to the Mill Lane auto-transformer station.

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

Brancote South cutting satellite compound

2.3.59 This compound will provide for civil engineering works (see Volume 2: Map CT-05-214, F8 to E7) and will:

- be operational for four years and three months, commencing during 2021;
- support 25 civil engineering workers per day (35 workers at peak times);
- provide four temporary materials stockpiles to the southern and northern sides of the Proposed Scheme (see Volume 2: Map CT-05-214, J7, H5 to G5, H7 to F7 and G8 to F7); and
- be accessed via Hanyards Lane for initial set up then via site haul route connecting to the A518 Weston Road.

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

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

Table 2: Demolitions to be managed from the Brancote South cutting satellite compound

Description	Location	Feature resulting in the demolition
Residential		
Two-storey farmhouse	Upper Hanyards Farm, Hanyards Lane	Brancote South cutting
Commercial		
Seven single storey barn/farm storages	Upper Hanyards Farm, Hanyards Lane	Brancote South cutting

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

- Ingestre green overbridge, which will take one year and six months to complete; and
- Tixall Bridleway 0.1628 accommodation overbridge, which will take nine months to complete.

2.3.63 The compound will be used to manage construction of the Brancote South cutting, which will take three years to complete. Material from the Brancote South cutting will be used as engineering material in neighbouring areas and locally within the Colwich to Yarlet area, where possible.

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

- two temporary diversions of Tixall Footpath 0.1630(b) will be required for a period of one year and six months. The first diversion of 175m, 20m south of its existing alignment, will divert users around overbridge earthworks. The second diversion of 525m, 150m north of its existing alignment, diverting users around the area of land required for construction connecting in to Tixall Bridleway 0.1628. On completion of construction, there will be permanent partial upgrade of 320m to join Tixall Bridleway 0.1628, and realignment of 90m of

Tixall Footpath 0.1630(b) by up to 50m west of its current alignment to cross the route of the Proposed Scheme via Tixall Bridleway 0.1628 accommodation overbridge;

- temporary diversion of Tixall Bridleway 0.1629, for 175m, moving 40m south-west around the Brancote South cutting satellite compound, for a period of three years; and
- two temporary diversions of Tixall Bridleway 0.1628 for a period of three years. The first diversion, 300m in length and 100m west of its existing alignment, will divert users around demolition works to Upper Hanyards Farm. The second diversion, 525m in length and 150m east of its existing alignment, will divert users around the area of land required for construction, connecting into Tixall Footpath 0.1630(b). On completion of construction, Tixall Bridleway 0.1628 will be permanently realigned and will cross the route of the Proposed Scheme, 200m south of its existing alignment, via the Tixall Bridleway 0.1628 accommodation overbridge.

2.3.65 The works to be managed from this compound will require diversion of a National Grid Gas Distribution 12 inch diameter high pressure gas pipeline for a distance of 680m, 320m south of its existing alignment to cross the Brancote South cutting, which will take nine months to complete.

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

Hopton South cutting satellite compound

2.3.67 This compound will provide for civil engineering works (see Volume 2: Map CT-05-215, C7 to C8) and will:

- be operational for three years and nine months, commencing during 2021;
- support 35 civil engineering workers per day (50 workers at peak times);
- provide six temporary materials stockpiles to the southern and northern sides of the Proposed Scheme (see Volume 2: Map CT-05-214, C6 to A6, CT-05-215, I6 and H6, C7 and C6, B5 and A5, CT-05-216, J6 to H6, I5 and H5);
- provide two transfer nodes, accessed from the A518 Weston Road (see Volume 2: Map CT-05-215, F6 to E6 and D6 to C7) for the storage and loading and unloading of bulk earthworks materials which will be moved to and from the site on public roads; and
- be accessed via the A518 Weston Road.

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

2.3.69 The works to be managed from this compound will require the demolition of buildings and structures, as detailed in Table 3.

Table 3: Demolitions to be managed from the Hopton South cutting satellite compound

Description	Location	Feature resulting in the demolition
Residential		
Two-storey farmhouse	Chase View, Hopton	Hopton embankment
Other		
Two outbuildings	Chase View, Hopton	Hopton embankment
Slab area	Staffordshire County Showground	Hopton South cutting

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

- Trent Walk underbridge, which will take one year and six months to complete;
- A518 Weston Road overbridge, which will take one year and six months to complete; and
- Hopton and Coton Footpath 24 accommodation overbridge, which will take one year and three months to complete.

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

- Brancote North cutting, which will take two years to complete;
- Hopton embankment, which will take two years and three months to complete; and
- Hopton South cutting, which will take one year and nine months to complete.

2.3.72 Material for the Hopton embankment will be received from Brancote North cutting and Hopton South cutting, from cuttings elsewhere along the Proposed Scheme and/or from borrow pits.

2.3.73 In addition, the compound will be used to manage construction of the Hopton retaining wall, which will take one year and three months to complete.

2.3.74 The works to be managed from this compound will require permanent realignment of the A518 Weston Road, 30m north of its existing alignment via the A518 Weston Road overbridge, which will take six months to complete. The A518 Weston Road will remain open during the construction of the A518 Weston Road overbridge and road realignment, during this time there will be tie-in works and traffic management, such as temporary lane closures of the A518 Weston Road, to connect the existing road with the new alignment. Highway works affecting access to Staffordshire County Showground parking areas and back-of-house facilities will include some local temporary access provision to maintain access at all times during the construction period.

2.3.75 The works to be managed from this compound will require temporary diversion of Trent Walk accommodation access. The diversion will be 175m in length and will be constructed offline, over a period of three months, approximately 75m east of its existing alignment. This diversion will be required for one year and six months, during the construction of the Trent Walk underbridge, to allow access to be maintained to

properties located to the north and south of the route of the Proposed Scheme. Following completion, Trent Walk accommodation access will be reinstated via the Trent Walk underbridge.

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

- temporary diversion of Hopton and Coton Footpath 24, 150m in length, for a period of one year and six month. The diversion, 20m north of its existing alignment, will divert users around overbridge earthworks. On completion of construction, a 175m length of the footpath will be permanently realigned, 30m east of its existing alignment, to cross the route of the Proposed Scheme on the Hopton and Coton Footpath 24 accommodation overbridge; and
- temporary diversion of Hopton and Coton Footpath 6 for a distance of 200m to join the permanent Hopton and Coton Footpath 6 diversion, 350m east of its existing alignment. The temporary diversion will divert users to the east of a material stockpile for a period of one year and six months. On completion of construction, Hopton and Coton Footpath 6 will be permanently diverted for 710m, 440m south of its existing alignment, to cross over the route of the Proposed Scheme on the Hopton and Coton Footpath 24 accommodation overbridge and join Hopton and Coton Footpath 7 to the north of the route.

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

- the diversion of a land drain via Hanyards Culvert, which will take nine months to complete;
- Berryhill (South) culvert, to convey an unnamed watercourse under the route of the Proposed Scheme, which will take nine months to complete;
- Berryhill (North) drop inlet culvert, which will take six months to complete; and
- Hopton culvert, which will comprise three separate culverts, to convey an unnamed watercourse from the Hopton Pools under the route of the Proposed Scheme, which will take nine months to complete.

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

Hopton North cutting satellite compound

2.3.79 This compound will provide for civil engineering and railway systems works (see Volume 2: Map CT-05-217, I7) and will:

- be operational for three years and nine months, commencing during 2021;
- support 30 civil engineering workers per day (40 workers at peak times);
- provide five temporary materials stockpiles to the southern and northern sides of the Proposed Scheme (see Volume 2: Map CT-05-216, F6 to E7, CT-05-217, I6 to H7, I5 to G5, G6 and F6); and

- be accessed via the via B5066 Sandon Road for site preparation and set up. Thereafter, heavy goods vehicles (HGVs) accessing the compound will be via a site haul route along the west of the route, and connection to the A518 Weston Road to the south.

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

2.3.81 The works to be managed from this compound will require the demolition of the following buildings and structures as described in Table 4.

Table 4: Demolitions to be managed from the Hopton North cutting satellite compound

Description	Location	Feature resulting in the demolition
Residential		
Four two-storey brick cottages	1, 2, 3 and 4 Mount Farm Barns,Hopton Lane	Hopton North cutting
Two-storey brick cottage	Bank Cottages, Hopton Lane	Hopton North cutting
Two-storey brick cottage	Long Meadow Cottage, Hopton Lane	Hopton North cutting
Brick cottage	The Mount, Hopton Lane	Hopton North cutting
Two-storey brick cottage	1 Mount Edge, Hopton Lane	Hopton North cutting
Farmhouse	Lower Bridge Farm	Hopton North cutting
Commercial		
Four barns/farm storage buildings	Lower Bridge Farm, Hopton Lane	Hopton North cutting
Other		
Outbuilding	The Mount, Hopton Lane	Hopton North cutting

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

- Hopton and Coton new footpath overbridge, which will take one year and nine months to complete;
- B5066 Sandon Road overbridge, which will take one year to complete; and
- Hopton and Coton Bridleway 11 accommodation overbridge, which will take one year to complete.

2.3.83 This compound will be used to manage construction of Hopton North cutting, which will take two years and three months to complete. Material from the Hopton North cutting will be used as engineering material in neighbouring areas and locally within the Colwich to Yarlet area, where possible.

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

- permanent diversion of Hopton Lane, 400m north of its existing alignment, to join the B5066 Sandon Road north of the route of the Proposed Scheme for a period of nine months. During construction, temporary lane closures and traffic control for 50m each end of Hopton Lane will be required over a period

of three months. The southern section is to be closed permanently to through-traffic and will provide access to the balancing pond;

- permanent diversion of Mount Edge, 225m in length and 125m south-west of its existing alignment for a period of nine months. There will also be a temporary diversion along the existing Sandon Lane, 1.2km in length to Mount Edge to maintain access to the existing B5066 Sandon Road for nine months during the construction period; and
- permanent realignment of B5066 Sandon Road, 1km in length and 100m north-west of its existing alignment, to cross the route of the Proposed Scheme via the B5066 Sandon Road overbridge. The existing B5066 Sandon Road will remain open during the construction of the B5066 Sandon Road overbridge. On completion of construction, there will be tie-in works and traffic management for three months to connect the existing road with the new alignment.

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

- temporary diversion of Hopton and Coton Bridleway 12, 180m in length, diverting users 50m north-east of its existing alignment for a period of one year and six months. On completion of construction, the section of bridleway by the B5066 Sandon Road will be re-instated; a 210m section of the bridleway will be permanently diverted 25m to the north of existing to connect to the Hopton and Coton Bridleway 11 accommodation overbridge;
- temporary diversion of Hopton and Coton Bridleway 11, 275m in length, diverting users 60m south-east of its existing alignment for a period of three years. On completion of construction, the Hopton and Coton Bridleway 11 will be permanently realigned via the Hopton and Coton Bridleway 11 accommodation overbridge; and
- temporary diversion of Hopton and Coton Bridleway 16, 475m in length and 175m south-west of its existing alignment, for a period of one year and six months. On completion of construction, 290m of Hopton and Coton Bridleway 16 will be permanently diverted to connect to Hopton and Coton Bridleway 11 accommodation overbridge, 165m south of its existing alignment.

2.3.86 The compound will be used to manage the construction of Sandon Road drop inlet culvert to convey an unnamed watercourse under the route of the Proposed Scheme, which will take nine months to complete.

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

- diversion a British Pipeline Agency 10 inch diameter fuel pipeline for a distance of 815m in length, 370m north of its existing alignment, which will take nine months to complete; and

- diversion a National Grid Gas Transmission 1050mm high pressure gas pipeline for a distance of 280m in length, crossing the route of the Proposed Scheme 55m north of its existing alignment, which will take nine months to complete.

2.3.88 This compound will manage the works to construct the foundations of the Sandon Road auto-transformer station, which will take one year and three months to complete.

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

Sandon Road auto-transformer station satellite compound

2.3.90 This compound will provide for the installation of the railway systems equipment at Sandon Road auto-transformer station (see Volume 2: Map CT-05-216, C6) and will:

- be operational for one year and three months, commencing during 2024;
- support 30 railway installation workers per day (40 workers at peak times); and
- be accessed from the diverted Mount Edge via the B5066 Sandon Road.

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

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

2.3.93 Other works that will be managed from this compound include site clearance, enabling works, and finalisation works including site reinstatement, fencing, planting, and landscaping.

Marston South embankment satellite compound

2.3.94 This compound will provide for civil engineering works (see Volume 2: Map CT-05-218, I4) and will:

- be operational for three years and nine months, commencing during 2021;
- support 20 civil engineering workers per day (30 workers at peak times);
- provide four temporary materials stockpiles to the east of the Proposed Scheme (see Volume 2: Map CT-05-217, C5, CT-05-218, H5 andG5, F5 and F5 to E5); and
- be accessed via Marston Lane for site preparation and set up then via the site haul route thereafter to the A34 Stone Road to the north-west.

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

2.3.96 The works to be managed from this compound will require the demolition of buildings and structures, as detailed in Table 5.

Table 5: Demolitions to be managed from the Marston South embankment satellite compound

Description	Location	Feature resulting in the demolition
Commercial		
Three single-storey outbuildings	Marston Lane	Marston South embankment
Outbuilding	Sunnyhill Farm	Marston South embankment
Other		
Slurry lagoon and silage clamp	Park Farm, Marston	Marston South embankment

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

- Marston Bridleway 8 accommodation underbridge, which will take six months to complete; and
- Marston Lane underbridge, which will take one year to complete.

2.3.98 The compound will be used to manage construction of Marston South embankment, which will take three years to complete.

2.3.99 Material for the Marston South embankment will be received from cuttings in the Colwich to Yarlet area, from elsewhere along the Proposed Scheme and/or from borrow pits.

2.3.100 The works to be managed from this compound will require permanent realignment of a section of Marston Lane, 800m in length and 200m north of its existing alignment, via the Marston Lane underbridge, which will take six months to complete. There will also be other minor works to Marston Lane to provide passing bays for construction traffic. These are described and assessed in Volume 4, Off-route effects.

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

- temporary diversion of Marston Bridleway 8 for a period of one year and six months during construction. This will divert users for a distance of 550m, 60m south-east, around the Marston Bridleway 8 accommodation underbridge and highway works during construction, to join Marston Footpath 10. On completion of construction, Marston Bridleway 8 will be permanently diverted via the Marston Bridleway 8 accommodation underbridge; and
- two temporary diversions of Marston Footpath 2 for a period of three years during construction. The first temporary diversion, 350m in length, will divert users east to the realigned Marston Lane, on the northern side of the Proposed Scheme. A second diversion route, 150m in length, will divert users west around an area of planting. The third temporary diversion, 500m in length, will join the A34 Stone Road, to the southern side of the Proposed Scheme. On completion of construction, Marston Footpath 2 will be permanently diverted by 375m, to join the realigned Marston Lane.

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

Marston North embankment satellite compound

2.3.103 This compound will provide for civil engineering works (see Volume 2: Map CT-05-219a, H6) and will:

- be operational for three years and six months, commencing during 2021;
- support 10 civil engineering workers per day (15 workers at peak times);
- provide five temporary materials stockpiles to the north-east of the Proposed Scheme (see Volume 2: Map CT-05-218, E5 and D5, D5, D5 and C5, C5 and B5 and CT-05-219a, I5 to G5); and
- be accessed via the A34 Stone Road.

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

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

2.3.106 The compound will be used to manage construction of Marston North embankment, which will take two years and three months to complete. Material for the Marston North embankment will be received from cuttings elsewhere along the Proposed Scheme and/or from borrow pits.

2.3.107 The compound will be used to manage the construction of Yarlet Wood drop inlet culvert to convey an unnamed watercourse under the route of the Proposed Scheme, which will take six months to complete.

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

Yarlet South cutting satellite compound

2.3.109 This compound will provide for civil engineering works (see Volume 2: Map CT-05-219a, F8 to E7) and will:

- be operational for three years and nine months, commencing during 2021;
- support 20 civil engineering workers per day (30 workers at peak times);
- provide four temporary materials stockpiles to the east and west of the Proposed Scheme (see Volume 2: Map CT-05-219a, D6 to C6, D5 to C5, C5, C6 to B6);
- provide one transfer node, accessed from the A34 Stone Road (see Volume 2: Map CT-05-219a, G8 and F8) for the storage and loading and unloading of bulk earthworks materials which will be moved to and from the site on public roads; and
- be accessed via the A34 Stone Road.

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

2.3.111 The works to be managed from this compound will require the demolition of buildings and structures, as detailed in Table 6.

Table 6: Demolitions to be managed from the Yarlet South cutting satellite compound

Description	Location	Feature resulting in the demolition
Residential		
Two-storey cottage	Middle Bank Farm, Yarlet	Yarlet South cutting
Two-storey cottage	Middle Bank Farm, Yarlet	Yarlet South cutting
Other		
Outbuilding	Middle Bank Farm, Yarlet	Yarlet South cutting

2.3.112 The compound will be used to manage the construction of the A34 Stone Road overbridge, which will take two years to complete.

2.3.113 The compound will be used to manage construction of Yarlet South cutting, which will take one year and three months to complete. Material from the Yarlet South cutting will be used as engineering material in neighbouring areas and locally within the Colwich to Yarlet area, where possible.

2.3.114 The works to be managed from this compound will require temporary offline diversion of 750m of the A34 Stone Road dual carriageway, 100m west of its existing alignment. Works will include widening works in some locations, and vehicle speeds will be restricted to 40mph (65kph). Lane restrictions and limited overnight or weekend lane closures will be required during the works to connect the existing road into the new alignment. This will take one year to complete.

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

- Yarlet Bank drop inlet culvert, for surface water flow under the route of the Proposed Scheme, which will take nine months to complete; and
- Peasley Bank drop inlet culvert, for surface water flow under the route of the Proposed Scheme, which will take nine months to complete.

2.3.116 This compound will manage the works to construct the foundations and building for the Yarlet express feeder auto-transformer station, which will take one year and three months to complete.

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

Yarlet express feeder auto-transformer station satellite compound

2.3.118 This compound will provide for the installation of the railway systems equipment for the Yarlet express-feeder auto-transformer station (see Volume 2: Map CT-05-219a, E5) and will:

- be operational for one year and three months, commencing during 2024;
- support 30 railway installation workers per day (40 workers at peak times);
- be accessed via the A34 Stone Road; and
- be managed from the Stone railhead main compound in the Stone and Swynnerton area (CA3).

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

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

2.3.121 Other works that will be managed from this compound include site clearance, enabling works, and finalisation works including site reinstatement, fencing, planting, and landscaping.

Construction waste and material resources

2.3.122 Excavated material generated across the Proposed Scheme will be reused as engineering fill material or in the environmental mitigation earthworks of the Proposed Scheme, where reasonably practicable.

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

2.3.124 Local excess or shortfall of excavated material within the Colwich to Yarlet area will be managed through the mitigation earthworks design approach adopted for the Proposed Scheme, as well as the use of borrow pits, with the aim of contributing to an overall balance of excavated material on a route-wide basis. The overall balance of excavated material is presented in Volume 3, Section 14.

Commissioning of the railway

2.3.125 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

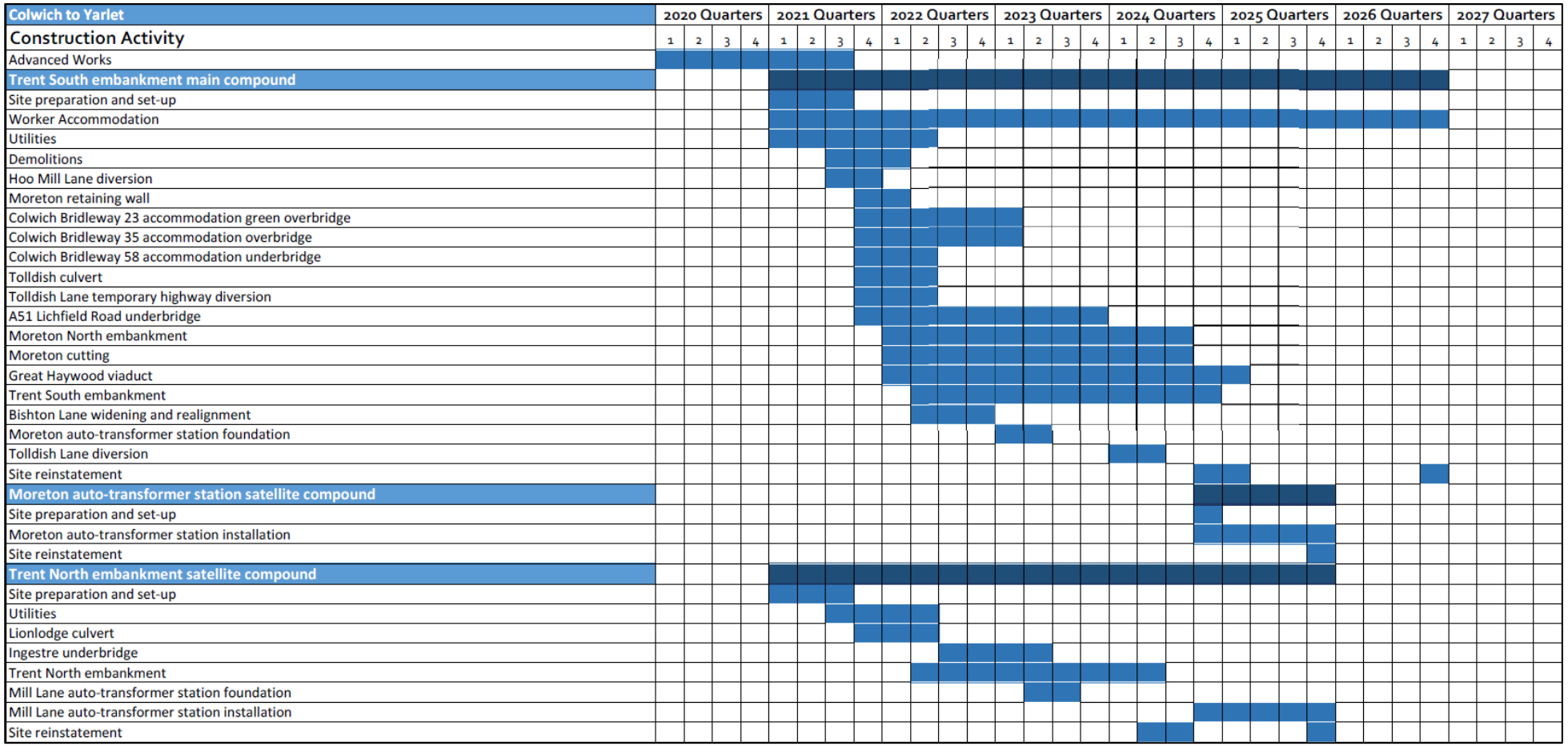
2.3.126 A construction programme illustrating indicative periods for each of the core construction activities described above is provided in Figure 6.

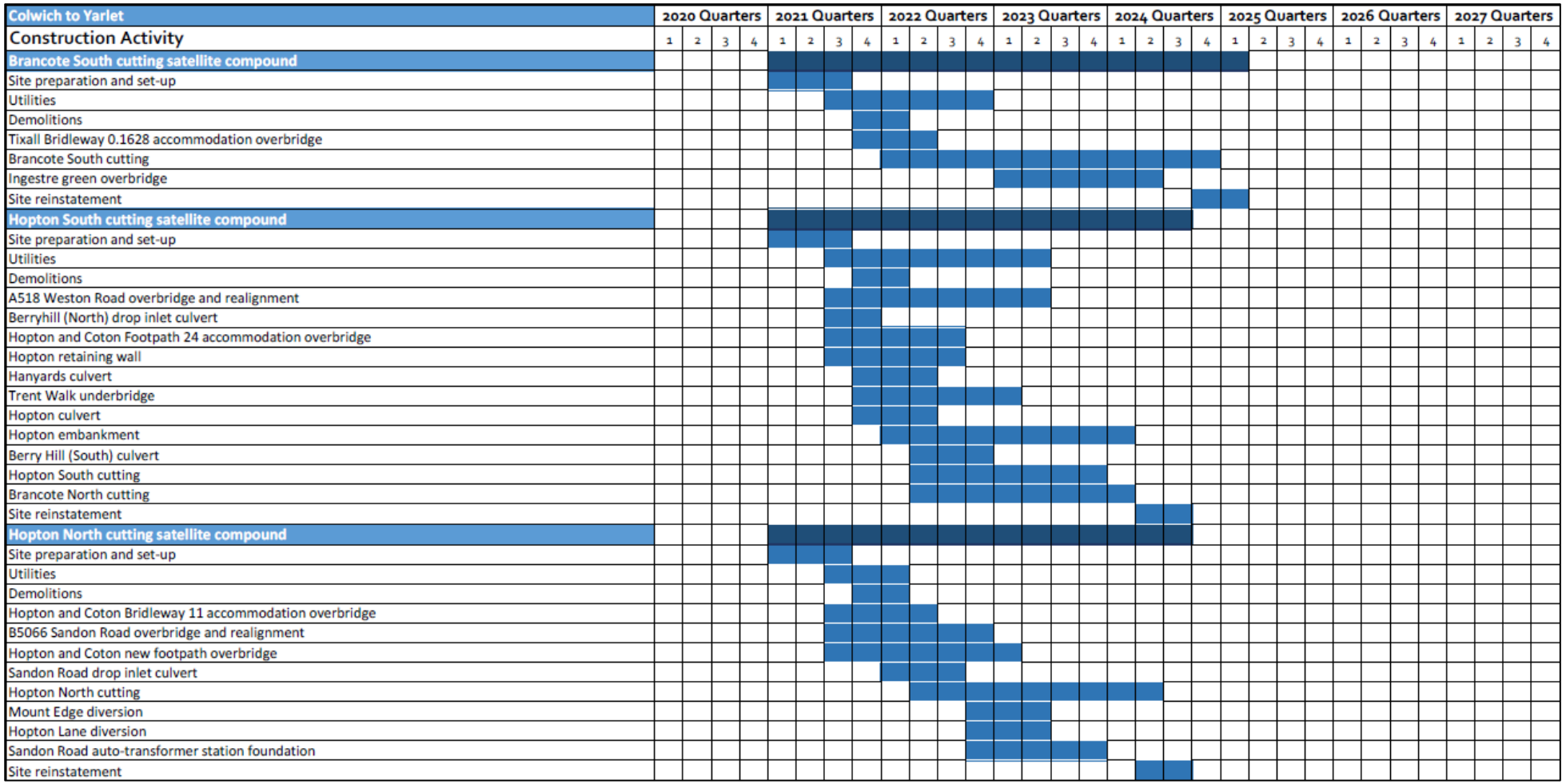
Monitoring during construction

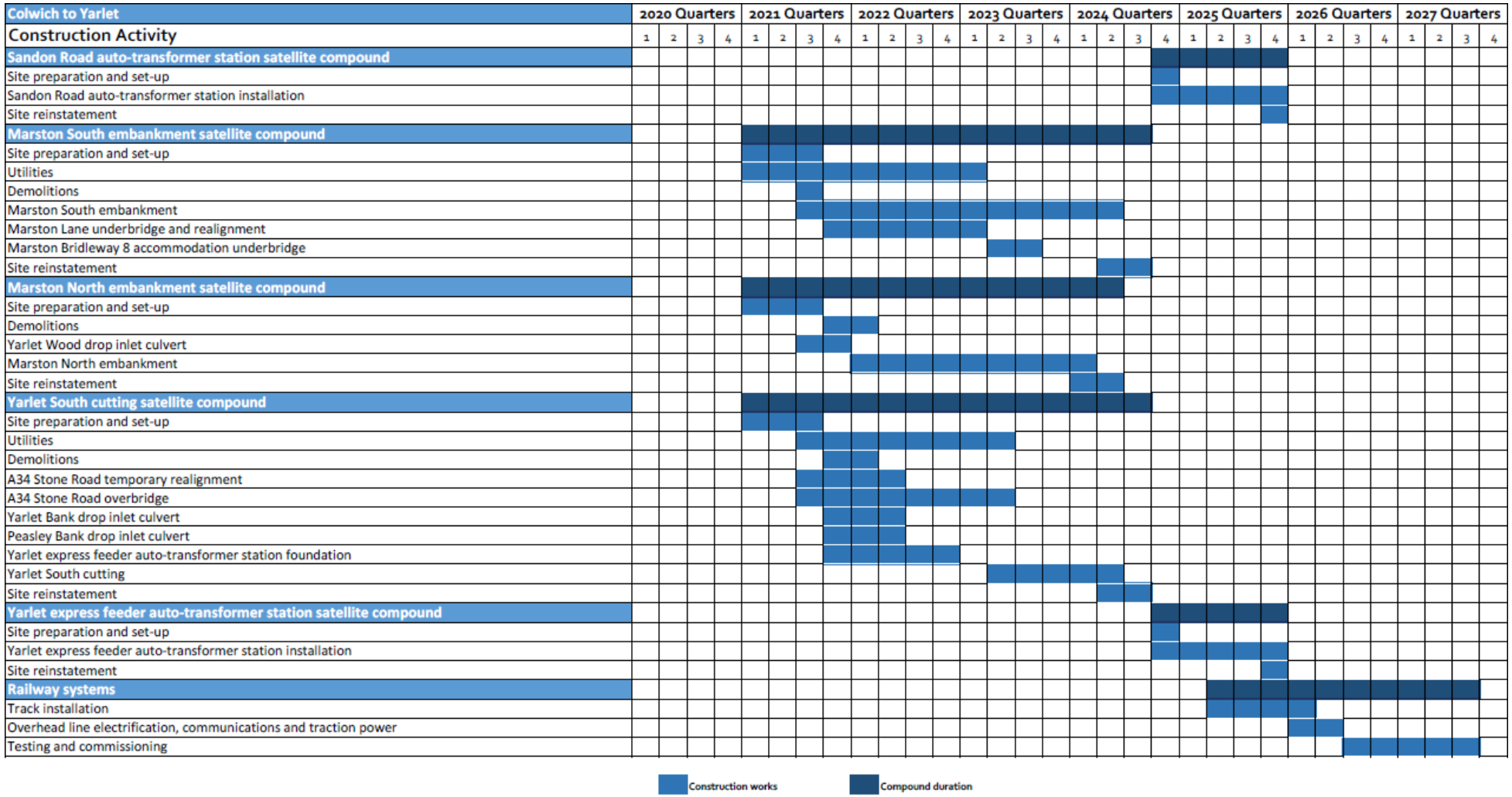
2.3.127 The appointed contractor will be required to undertake the necessary monitoring for each environmental topic to comply with the requirements of the CoCP and any additional consent requirements. Any actions that may be necessary for compliance will be reported to the nominated undertaker and remedial action identified.

2.3.128 The CoCP will set out inspection and monitoring procedures to assess the effectiveness of measures to prevent or reduce environmental effects during construction. Relevant local authorities and consenting authorities, such as the Environment Agency, will be consulted on the monitoring procedures to be implemented prior to construction commencement, as appropriate.

Figure 6: Indicative construction programme between 2020 and 2027




Colwich to Yarlet
2020 Quarters
2021 Quarters
2022 Quarters
2023 Quarters
2024 Quarters
2025 Quarters
2026 Quarters
2027 Quarters
Construction Activity
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
Brancote South cutting satellite compound
Site preparation and set-up
Utilities
Demolitions
Tixall Bridleway 0.1628 accommodation overbridge
Brancote South cutting
Ingestre green overbridge
Site reinstatement
Hopton South cutting satellite compound
Site preparation and set-up
Utilities
Demolitions
A518 Weston Road overbridge and realignment
Berryhill (North) drop inlet culvert
Hopton and Coton Footpath 24 accommodation overbridge
Hopton retaining wall
Hanyards culvert
Trent Walk underbridge
Hopton culvert
Hopton embankment
Berry Hill (South) culvert
Hopton South cutting
Brancote North cutting
Site reinstatement
Hopton North cutting satellite compound
Site preparation and set-up
Utilities
Demolitions
Hopton and Coton Bridleway 11 accommodation overbridge
B5066 Sandon Road overbridge and realignment
Hopton and Coton new footpath overbridge
Sandon Road drop inlet culvert
Hopton North cutting
Mount Edge diversion
Hopton Lane diversion
Sandon Road auto-transformer station foundation
Site reinstatement


Colwich to Yarlet
2020 Quarters
2021 Quarters
2022 Quarters
2023 Quarters
2024 Quarters
2025 Quarters
2026 Quarters
2027 Quarters
Construction Activity
1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4 1 2 3 4
Sandon Road auto-transformer station satellite compound
Site preparation and set-up
Sandon Road auto-transformer station installation
Site reinstatement
Marston South embankment satellite compound
Site preparation and set-up
Utilities
Demolitions
Marston South embankment
Marston Lane underbridge and realignment
Marston Bridleway 8 accommodation underbridge
Site reinstatement
Marston North embankment satellite compound
Site preparation and set-up
Demolitions
Yarlet Wood drop inlet culvert
Marston North embankment
Site reinstatement
Yarlet South cutting satellite compound
Site preparation and set-up
Utilities
Demolitions
A34 Stone Road temporary realignment
A34 Stone Road overbridge
Yarlet Bank drop inlet culvert
Peasley Bank drop inlet culvert
Yarlet express feeder auto-transformer station foundation
Yarlet South cutting
Site reinstatement
Yarlet express feeder auto-transformer station satellite compound
Site preparation and set-up
Yarlet express feeder auto-transformer station installation
Site reinstatement
Railway systems
Track installation
Overhead line electrification, communications and traction power
Testing and commissioning
Construction works
Compound duration

2.4 Operation of the Proposed Scheme

Operational specification

Introduction

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

HS2 services

2.4.2 It is anticipated that there will be up to six trains per hour in each direction upon opening in 2027, increasing to up to 12 trains per hour each way passing through the Colwich to Yarlet area when, from 2033 , the full Phase Two route is operational. Services are expected to operate between 05:00 and 24:00 from Monday to Saturday and 08:00 and 24:00 on Sunday.

2.4.3 In this area, trains will run at speeds of up to 225mph (360kph). The trains will be either single 200m trains or two 200m trains coupled together (i.e. 400m), depending on demand and time of day.

Maintenance

2.4.4 Volume 1, Section 4 describes the maintenance regime for the Proposed Scheme.

2.4.5 Asset performance and condition monitoring will be undertaken using asset condition monitoring and unattended measurement systems fitted to the HS2 passenger rolling stock. Intrusive inspections will be carried out during the maintenance period. The maintenance approach will be a combination of risk based, preventative and reactive maintenance.

2.4.6 Provision for railway maintenance vehicles will be made at the HS2 Infrastructure Maintenance Base - Rail (IMB-R) near Stone in the Stone and Swynnerton area (CA3). Further information on the Stone IMB-R can be found in Volume 2: Community area 3, Stone and Swynnerton.

Operational waste and material resources

2.4.7 The assessment of the likely significant environmental effects associated with the disposal of operational waste has been undertaken for the Proposed Scheme as a whole in Volume 3, Section 15.

2.4.8 Forecasts of the amount of waste arising from track maintenance and ancillary infrastructure and the associated likely significant environmental effects are provided in Volume 5: Appendix WM-001-000.

Monitoring during operation

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

2.5 Route section alternatives

Introduction

2.5.1 Since November 2015, as part of the design development process, a series of potentially feasible amendments to the Proposed Scheme have been identified and reviewed within workshops attended by engineering, construction, planning and environmental specialists. During the workshops, a comparison was conducted of each design option, which included consideration of:

- engineering requirements: the degree of design complexity of the alternatives and the impact this would have on construction durations and construction and operational costs;
- cost: whether the alternatives would be more cost effective or incur additional costs; and
- potential environmental impact: whether the alternatives would have more or less environmental impact (e.g. sound, noise and vibration and landscape and visual).

2.5.2 The comparison also considered, as appropriate, feedback provided through stakeholder engagement and responses to the consultation between September and November 2016 on the working draft EIA Report and the Design Refinement Consultation.

2.5.3 The following sections detail the reasonable local alternatives studied and the main reasons for selecting the option to be taken forward into the Proposed Scheme. The environmental impacts of the option selected (the Proposed Scheme) are then presented, followed by the environmental impacts of the alternative options compared to those of the Proposed Scheme. Other considerations are also noted including engineering requirements and cost. In some cases a preliminary appraisal of options has been undertaken, whereby options have been considered in terms of whether they are reasonable against environmental, technical and design criteria, and should, therefore, be progressed for further consideration.

2.5.4 In considering the environmental impacts, all EIA topics have been taken into account, however, only those topics where there is a potential impact are reported. During the preparation of the EIA, alternatives were appraised against the baseline scheme, however in accordance with the new Environmental Impact Assessment (EIA) Directive (2014/52/EU) that was implemented by the Town and Country Planning (Environmental Impact Assessment) Regulations that came into force on 16 May 2017, the comparison is presented below against the Proposed Scheme.

Route alignment at Moreton House

2.5.5 During the design development process since the announcement of the preferred route to Crewe in November 2015, further consideration has been given to the route of the Proposed Scheme and its proximity to the Grade II listed Moreton House. Options to realign the route as it passes Moreton House have been a key consideration in the development of the design. Since the development of these alternatives, it has been confirmed that Moreton House is occupied by Mayfield

Children's Home, which is used as a residential home for young people with autism and learning difficulties.

2.5.6 A preliminary options appraisal was undertaken of seven options, of which five options were not taken forward for further consideration as they were not considered to be reasonable alternatives:

- Options A4.1a would include a cutting, up to 18m in depth and over 100m in width, approximately 60m south of Moreton House. The horizontal alignment would increase the available space for construction of the route, an accommodation access overbridge and a landscape bund. In moving the alignment south, it would increase the noise and visual impacts on Moreton Grange and its neighbouring properties, and therefore was not taken forward for further consideration;
- Option A4.2 would include a cutting, up to 11m in depth, approximately 40m south of Moreton House. This option would require an increase in the height of the embankment, adjacent to Moreton Grange and its neighbouring properties, with subsequent increases to noise and visual impacts, so this option was not taken forward for further consideration;
- Option A4.1b would combine elements of Options A4.1a and A4.2, and would include a cutting approximately 115m in width and up to approximately 11m in depth, approximately 60m from Moreton House at the closest point. However, in moving the route further south from Moreton House, this option would bring the route closer to Moreton Grange Farm and associated residential properties, so this option was not taken forward for further consideration;
- Option A4.3a considered the use of a technique known as 'soil nailing', which would allow the steepening of slopes, and reduce the amount of land required for the Proposed Scheme. However, there were concerns that this technique may not be effective for the whole lifetime of the project, which would lead to increased risk of failure of the slopes, so this option was not taken forward for further consideration; and
- Option A4.4 would include a green bridge, approximately 35m in width, located to the south of Moreton House, to help integrate the route into the surrounding landscape and to reduce impacts upon the setting of Moreton House. However, further analysis indicated that the area of land between the green bridge and Moreton House would be insufficient to integrate the green bridge into the surrounding landscape. Furthermore, the green bridge would be complex and expensive to construct, together with the additional costs associated with maintenance and the level of inspection that would be required. It was, therefore, considered that it would be preferable to consider landscape mitigation associated with the other options, so this option was not taken forward for further consideration.

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

- Option A4.0: the route would pass through Moreton in a cutting approximately 115m in width and up to approximately 19m in depth, approximately 40m from Moreton House at the closest point. A realigned access road to Moreton House would cross the cutting on the Colwich Bridleway 23 accommodation overbridge and run parallel to the route, resulting in the demolition of one building associated with Moreton House Farm. The Moreton auto-transformer station would be located on the southern side of the route of the Proposed Scheme; and
- Option A4.3b: the route would pass through Moreton in a cutting approximately 115m in width and up to 19m in depth, approximately 40m from Moreton House at the closest point. A retaining wall would be provided on the northern side of the cutting, approximately 210m in length and up to 10m in height, to reduce the width of the cutting to the south-east of Moreton House. A realigned access road to Moreton House would cross the cutting on the Colwich Bridleway 23 accommodation overbridge and would run parallel to the route and adjacent to a building associated with Moreton House Farm. The Moreton auto-transformer station would be located on the northern side of the route of the Proposed Scheme.

2.5.8 Option A4.3b was taken forward into the Proposed Scheme as, on balance, it presented the most favourable environmental outcome. Option A4.0 in comparison would present an increase in environmental impacts. Most notably impacts on Moreton House Farm, where one of its buildings would require demolition and an increase in noise and visual impacts, associated with the auto-transformer station, for residents at Moreton Grange and neighbouring properties.

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

Option A4.3b

2.5.10 Option A4.3b would result in land, to the south of Moreton House being required permanently. This would result in the loss of formal gardens, including the removal of a 'ha-ha'[21]. The construction of a retaining wall would reduce the width of the cutting and the area of land required to the south of Moreton House. Access to Moreton House would be maintained via a realigned access road. No demolitions would be required with this option. With the auto-transformer station being located on the northern side of the route, the Moreton North embankment would provide visual and acoustic screening for residents at Moreton Grange and its neighbouring properties.

2.5.11 Option A4.3b would introduce construction risks and complexities, associated with the retaining wall.

Option A4.0

2.5.12 In comparison to Option A4.3b (the Proposed Scheme), Option A4.0 would result in a wider cutting, therefore requiring more land permanently. The wider cutting would require the access road to Moreton House to be realigned further north. This

[21] A sunken ditch designed to prevent animals from entering the garden. It marks the southern boundary of the formal gardens at Moreton House.

realignment would require the demolition of a residential property, associated with Moreton House Farm. The auto-transformer station would be located to the south of Moreton North embankment, approximately 50m north-west of Moreton Grange. Compared with Option 4.3b, residents at Moreton Grange and its neighbouring properties would be subject to increased noise and visual impacts associated with the auto-transformer station.

2.5.13 Option A4.0 does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme. The volume of traffic movements required to remove material from the cutting would be greater.

Route alignment at Ingestre Park Golf Club

2.5.14 During the design development process since the announcement of the preferred route to Crewe in November 2015, further consideration has been given to the route of the Proposed Scheme as it passes through Ingestre Park Golf Club. There is a deep cutting in this location, and opportunities to reduce the depth and width of the cutting were considered in order to reduce the impact on the golf club and the wider landscape.

2.5.15 The following four options were subject to a detailed appraisal where engineering and construction feasibility, cost and environmental impacts were considered:

- Option A5.0: the route would pass to the south of Ingestre, on an embankment before entering a cutting, approximately 1.5km in length, up to 110m in width and up to 21m in depth;
- Option A5.1: the route would pass to the south of Ingestre, on an embankment before entering a cut-and-cover green tunnel, approximately 1.5km in length, including portals, and up to 17m in depth. The landscape would be reinstated above the route of the Proposed Scheme;
- Option A5.2: the route would pass to the south of Ingestre, on an embankment before entering a cutting, approximately 1.6km in length, up to 85m in width and up to 12m in depth. The raised alignment would reduce the depth and footprint of the cutting; and
- Option A5.3: the route would pass to the south of Ingestre, on an embankment before entering a cutting approximately 1.6km in length, up to 108m in width and up to 15m in depth. This option has been refined from Option A5.0 to provide sufficient clearances at watercourse crossings to the north-west, and the Macclesfield to Colwich Line at the Great Haywood viaduct, to the south-east.

2.5.16 Option A5.3 was taken forward into the Proposed Scheme. Whilst Option A5.1 would provide greater environmental benefits, when compared to Option A5.3 the significant technical complexities associated with a cut-and-cover tunnel outweighed the environmental benefits. Option A5.0, in comparison to Option A5.3, would present an increase in environmental impacts, most notably an impact upon the local groundwater regime resulting from a deeper cutting; and therefore a drop inlet culvert would be required, which would potentially impact upon the hydromorphology and groundwater. This option would also be more expensive to construct and

maintain than Option A5.3. Option A5.2 would have a higher alignment compared to Option A5.3, resulting in less of an impact on hydromorphology and groundwater, but making the route more visible and thus having a greater visual impact.

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

Option A5.3

2.5.18 Option A5.3 would require the permanent acquisition of land from Ingestre Park Golf Club for the alignment of the route, thereby impairing the operation of this facility. There would be an impact on the historic landscape character in the area, most notably around Ingestre and Tixall. There would also be an impact on the setting of Ingestre Conservation Area (including Ingestre parkland) and a small number of listed buildings. This option would result in the loss of ecological habitat, including the southern tip of Lionlodge Covert, a local wildlife site featuring an inland salt meadow and with a potential impact on protected species. There would potentially be impacts upon the local groundwater regime resulting from the deep cutting, however there is sufficient clearance for a regular culvert, thereby avoiding the need for a drop inlet culvert.

2.5.19 Option A5.3 does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option A5.0

2.5.20 In comparison with Option A5.3 (the Proposed Scheme), Option A5.0 would result in a slight increase in the potential impact on the local groundwater regime resulting from a deeper cutting. A drop inlet culvert would be required, which would potentially impact upon the hydromorphology and groundwater within the immediate locality, and would result in significant additional maintenance requirements and costs when compared to Option A5.3.

2.5.21 Option A5.0 would not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme. Owing to the increased cutting depth, this option would be significantly more expensive to construct and maintain than the Proposed Scheme, due to the volume of excavated material to be removed and corresponding traffic movements would be increased compared to Option A5.3.

Option A5.1

2.5.22 In comparison with Option A5.3 (the Proposed Scheme), Option A5.1 would require the construction of a cut-and cover tunnel, porous portals and associated infrastructure. This option would allow the landscape to be reinstated above the tunnel and thereby reduce the setting impacts on the historic landscape and Ingestre Conservation Area, compared with Option 5.3. Similarly, noise impacts would be significantly reduced at Ingestre. The tunnel would largely pass beneath Ingestre Park Golf Club, reducing the land permanently required and the loss of land within the golf course compared to Option 5.3. Impacts on agricultural land and holdings would therefore be reduced.

2.5.23 The volume of material being removed for the tunnel and the corresponding traffic movements would be greater than Option 5.3. The tunnelling through this area would also increase the risk to groundwater resources. This option introduces significantly greater technical and construction complexities than Option 5.3, which would be more expensive to construct than the Proposed Scheme and the costs of maintenance would be higher due to the need to maintain the headhouse and ventilation equipment and the increased level of inspection that would be required. This option would also increase the construction risks and lengthen the construction programme.

Option A5.2

2.5.24 In comparison with Option A5.3 (the Proposed Scheme), Option A5.2 would result in a slight decrease in the potential impact upon the local groundwater regime resulting from a shallower cutting. The width of the cutting would be less than Option A5.3, resulting in slightly reduced impacts on the operation of Ingestre Park Golf Club, and the land required. The raised alignment of this option would increase both the visibility of the route and associated overhead line equipment, and thereby the potential for impacts upon the landscape character. Overall, this option would result in greater landscape and visual impacts than the Proposed Scheme.

2.5.25 Option A5.2 is slightly less expensive to construct than the Proposed Scheme and does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme. However, owing to the reduced cutting depth, the volume of excavated material to be removed would be reduced when compared to Option A5.3.

Route alignment at Hopton

2.5.26 During the design development process since the announcement of the preferred route to Crewe in November 2015, further consideration has been given to the route of the Proposed Scheme, the impact on residents of Hopton and to ensure there is sufficient clearance over an unnamed watercourse (a tributary of the Kingston Brook). In this area, the route of the Proposed Scheme would pass on embankment, which would support landscape earthworks and a retaining wall forming a false cutting, then continue into cutting, south-west of the majority of properties located in Hopton.

2.5.27 A preliminary options appraisal was undertaken of six options and one option was not taken forward for further consideration as it was not considered to be a reasonable alternative. This option (Option A6.2) would follow a similar alignment to Option A6.1 and included a green tunnel, approximately 530m in length, with landscaped earthworks required to tie in to the adjacent earthworks, to the south-east of Hopton. The land required permanently for the landscape earthworks would result in the loss of agricultural land holdings and demolition of several residential properties on the south-east of Hopton. This would be a highly complex and expensive option, together with the additional costs required to maintain a headhouse and ventilation equipment and the increased level of inspection that would be required. This option would also increase the construction risk and length of construction programme. As such, this option was not taken forward for further consideration.

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

- Option A6.0: the route would be partially located within a false cutting[22] with retaining wall on the northern side of the route, up to 4m in height, with the unnamed watercourse (a tributary of the Kingston Brook) crossing beneath the route, in a culvert (initially this was a drop inlet culvert). To the south-east of Hopton, the route would be in a cutting, approximately 100m in width and up to 16m in depth;
- Option A6.1: the route would be partially located within a false cutting with a retaining wall on the northern side of the route, up to 4m in height, with the route alignment raised by approximately 2m to allow sufficient clearance for an unnamed watercourse (a tributary of the Kingston Brook) to cross beneath the route in a culvert;
- Option A6.3a: the route would be located within a green tunnel of approximately 700m in length, including portals, and up to 10m in depth. An unnamed watercourse (a tributary of the Kingston Brook) would cross beneath the route in a drop inlet culvert or inverted siphon;
- Option A6.3b: the route would be partially located within a false cutting, with a retaining wall on the northern side of the route, up to 4m in height. The cutting would be up to 21m in depth at an unnamed watercourse (a tributary of the Kingston Brook), with the watercourse crossing beneath the route in a drop inlet or inverted siphon; and
- Option A6.4: the route would pass through the south of Hopton in a cut-and-cover tunnel, approximately 2.1km in length, including portals, and up to 15m in depth. The landscape and an unnamed watercourse (a tributary of the Kingston Brook), would be reinstated above the Proposed Scheme. The watercourse would be reinstated on its existing alignment in a concrete channel.

2.5.29 Option A6.0 was taken forward into the Proposed Scheme. Whilst Option A6.4 in comparison would provide greater environmental benefits, on balance they were outweighed by the significant technical complexities associated with a cut-and-cover tunnel. Option A6.3b in comparison to Option A6.0 would also provide greater environmental benefits, however, this option would present greater technical and construction complexities. Option A6.1 in comparison to Option A6.0 would present an increase in environmental impacts, most notably an increase in landscape and visual impacts for residents of Hopton. Option A6.3a, in comparison to Option A6.0, would present an increase in environmental impacts, most notably noise, landscape and visual impacts during the construction of the tunnel, and the residual impacts upon the landscape resulting from the mounded tunnel covering and visual impacts associated with the tunnel and porous portals.

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

[22] A means of screening a linear feature by forming a landscape earthwork alongside it, above existing ground level, to create the visual impression that the feature is situated in a cutting below ground level.

Option A6.0

2.5.31 Option A6.0 would introduce significant flood risk due to the large existing surface water flow path through this area, and would increase the risk to groundwater resources. This option would require the demolition of five properties. An unnamed watercourse (a tributary of the Kingston Brook) would cross beneath the route in a culvert, without the need to raise the route alignment.

2.5.32 Option A6.0 would not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option A6.1

2.5.33 In comparison to Option A6.0 (the Proposed Scheme), Option A6.1 would result in improvements to water quality and flood risk by increasing the clearance over the tributary of the Kingston Brook. More land would be required for the construction and operation, increasing the number of potential demolitions. Compared to Option A6.0, the reduced cutting depth would increase the noise and visual impact at properties on the southern edge of Hopton.

2.5.34 Option A6.1 would not introduce any technical or construction complexities. The reduced cutting depth associated with this option would present a reduction in the construction traffic numbers associated with removal of excavated material.

Option A6.3a

2.5.35 Compared to Option A6.0 (the Proposed Scheme), Option A6.3a would require the formation of a cut-and-cover tunnel, porous portals and associated infrastructure which would result in significantly more land required temporarily. It would also cause significant temporary landscape, visual and noise effects during construction. The tunnel depth would not be enough to reinstate the existing ground level, and would need to be re-landscaped, thereby creating an artificial mound. There would be significant obstruction to the overland flow path due to infilling at the B5066 Sandon Road, compared with Option A6.0. The reduced depth introduces the requirement for an inverted siphon at the unnamed watercourse (a tributary of the Kingston Brook), which would result in increased maintenance requirements and costs. There would be significant noise benefits from the route being in tunnel at this location, compared to Option A6.0.

2.5.36 The volume of material being removed for the tunnel and the corresponding traffic movements required would be greater than Option A6.0. The tunnel through this area would also increase the risk to groundwater resources. This option introduces significantly greater technical and construction complexities when compared to Option A6.0, which would also increase the construction risks and lengthen the construction programme. This option would be significantly more expensive to construct than the Proposed Scheme and the costs of maintenance would be higher due to the need to maintain the headhouse and ventilation equipment, and the increased level of inspection that would be required.

Option A6.3b

2.5.37 Compared to Option A6.0 (the Proposed Scheme), Option A6.3b would result in a slight reduction to the visual impacts. Due to the increased cutting depth, and the

presence of a false cutting, the route would be less prominent in the view from properties along the southern edge of Hopton. However, to the west of Hopton, visual impacts would increase slightly, owing to the deepening of the cutting. This option would present a reduction by one in the number of properties to be demolished. As a result of lowering the alignment, the unnamed watercourse (a tributary of the Kingston Brook) would cross the route in a drop inlet culvert or inverted siphon, which would result in additional maintenance and construction costs.

2.5.38 Option A6.3b does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option A6.4

2.5.39 Compared to Option A6.0 (the Proposed Scheme), Option A6.4 would require the formation of a cut-and-cover tunnel, porous portals and associated infrastructure which would result in significantly more land required temporarily, compared to Option A6.0. The depth of the tunnel would allow the landscape to be reinstated to existing ground level. It would also enable the unnamed watercourse to retain its existing alignment, above the tunnel. In addition, Hopton Lane would be reinstated on its existing alignment. There would be significant noise, visual, landscape and community benefits from the route being in tunnel at this location.

2.5.40 The volume of material being removed for the tunnel and the corresponding traffic movements would be greater than Option A6.0. The tunnel through this area would also increase the risk to groundwater resources. This option introduces significantly greater technical and construction complexities, which would also increase the construction risks and lengthen the construction programme.

Route alignment between Staffordshire County Showground and Yarlet (including Hopton and Marston)

2.5.41 During the design development process since the announcement of the preferred route to Crewe in November 2015, further consideration has been given to the route of the Proposed Scheme between Staffordshire County Showground and Yarlet. Options to realign the route as it passes through Hopton and close to the settlements of Marston and Yarlet have been considered. The sensitivity of this location, particularly the historic landscape and the proximity of the route to residential properties at Hopton, Yarlet and Marston, Moreton House and the Staffordshire County Showground, have been key considerations in the development of these alternatives.

2.5.42 A preliminary options appraisal was undertaken of eight options of which two options were not taken forward for further consideration as they were not considered to be reasonable alternatives:

- Option B5-7.2b included a bored tunnel from Ingestre to Hopton, approximately 4.25km in length. The tunnel portal would be located within Ingestre Park Golf Club, which due to the scale of construction works would result in a significant loss of elements of the high value historic landscape within Tixall and Ingestre, including the setting of Ingestre Hall and the Capability Brown landscape, and would likely result in the loss of the majority of the golf club. This option would also add significant additional cost to the

project. As such this option was not taken forward for further consideration; and

- Option B5-7.4a presented a minor variation to alignment in Option B5-7.4b. There were no significant differences between two options and the impacts would likely be similar, however Option B5-7.4a would be located slightly closer to Pasturefields Special Area for Conservation (SAC) and Site of Special Scientific Interest (SSSI), so was not taken forward for further consideration.

2.5.43 The following six options as illustrated in Figure 7 were taken forward to a more detailed appraisal where engineering and construction feasibility, cost and environmental impacts were considered:

- Option B5-7.0: the route would be located approximately 20m from the southern boundary of the Staffordshire County Showground, approximately 20m from the southern edge of the properties in Hopton, approximately 30m from the northern edge of properties in Marston, and approximately 20m from the northern edge of Yarlet. This option covers a distance of approximately 11km;

- Option B5-7.1: the route would follow a similar alignment to Option B5-7.0 and would be located approximately 30m from the southern boundary of the Staffordshire County Showground, approximately 30m from the southern edge of properties in Hopton, approximately 40m from the northern edge of properties in Marston, approximately 30m north from the northern edge of properties in Yarlet, and approximately 200m south-west of Yarlet School. This option covers a distance of approximately 11km;

- Option B5-7.2a: the route would pass under Hopton and the Staffordshire County Showground in a bored tunnel approximately 2km in length. The route would follow the same horizontal alignment as Option B5-7.1, covering a distance of approximately 11km;

- Option B5-7.3a: the route would be located away from Hopton, Marston and Yarlet, and would be located approximately 100m north of Little Ingestre. The route would pass through Hopton Heath registered battlefield and would be located approximately 150m to the south of Pasturefields SAC and SSSI and approximately 1km to the south-west of Salt. This option covers a distance of approximately 21km;

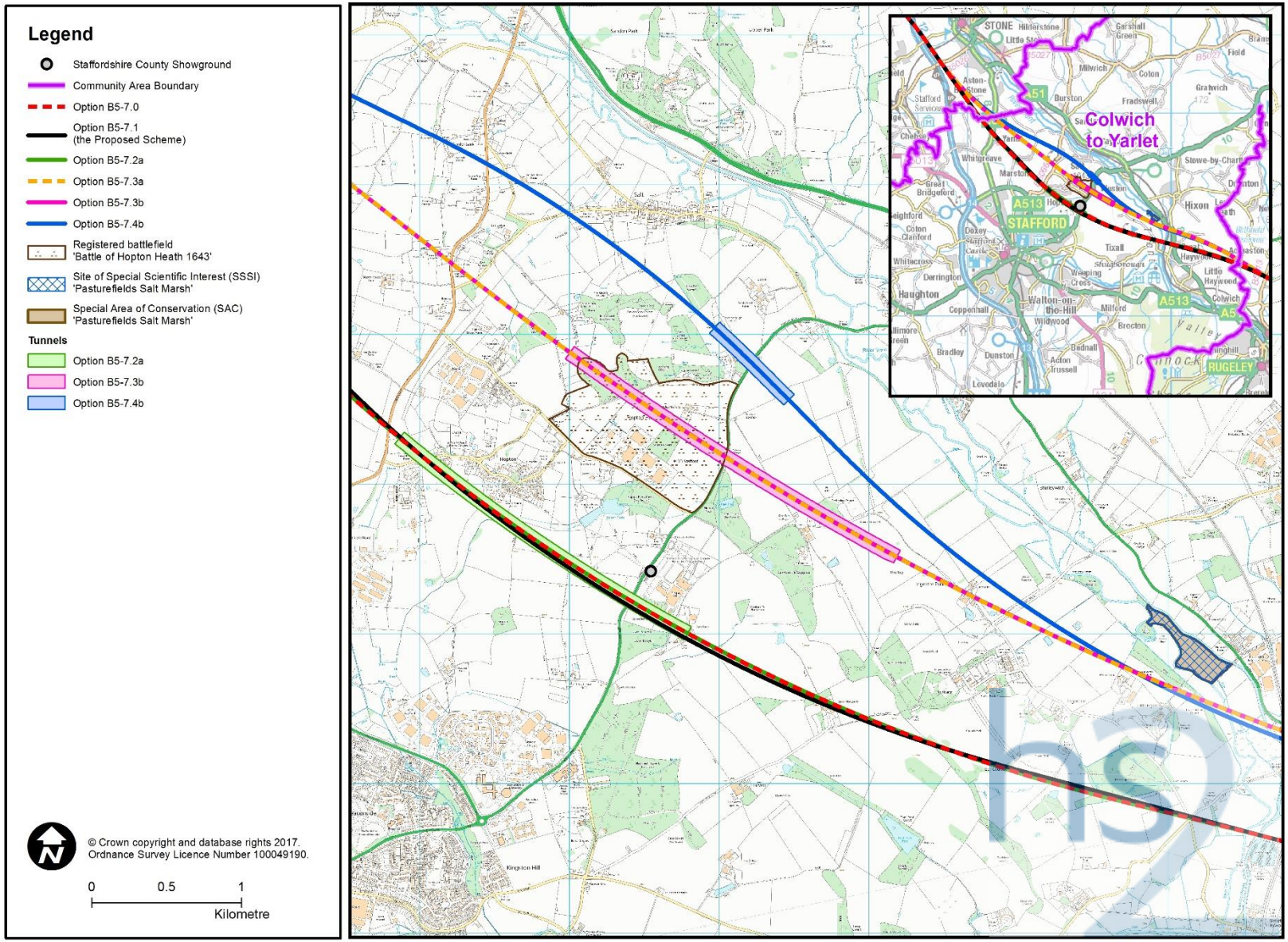
- Option B5-7.3b: the route would be located to the north-east of Hopton, Marston and Yarlet, and would be located approximately 50m north of Little Ingestre. The route would pass under Hopton Heath Registered Battlefield in a bored tunnel, approximately 2.2km in length and would be located approximately 150m to the south of Pasturefields SAC and SSSI, which is located approximately 1km to the south-west of Salt. This option covers a distance of approximately 21km; and

- Option B5-7.4b: the route would be located to the north-east of Hopton, Marston and Yarlet, and would be located approximately 50m north of Little Ingestre. The route would pass just under the north-east corner of Hopton

Heath Registered Battlefield, in a bored tunnel of approximately 500m in length and approximately 150m to the south of Pasturefields SAC and SSSI, which is located approximately 250m to the south-west of Salt. This option covers a distance of approximately 21km.

2.5.44 Option B5-7.1 was taken forward into the Proposed Scheme. Whilst Option B5-7.2a would provide greater environmental benefits, when compared to Option B5-7.1 it was outweighed by the significant technical complexities associated with a bored tunnel. Option B5-7.0 in comparison to Option B5-7.1 would present a slight increase in environmental impacts, notably the demolition of a building within Staffordshire County Showground. Options B5-7.3a and B5-7.3b, in comparison to Option B5-7.1, would present an increase in environmental impacts, most notably the partial loss of Hopton Heath Registered Battlefield; noise, landscape and visual impacts in and around Ingestre; and potential impacts upon springs that support the saltmarsh at Pasturefields SAC and SSSI. Option B5-7.4b, in comparison to Option B5-7.1, would present an increase in environmental impacts, most notably the setting of the Hopton Heath registered battlefield.

Figure 7: Options considered as part of the appraisal



Option B5-7.1

2.5.45 Option B5-7.1 would result in the need to demolish properties and would introduce visual, noise and amenity impacts in Hopton, Marston and Yarlet. The land required permanently would result in the loss of land within Ingestre Park Golf Club and the loss of land within Staffordshire County Showground. This option would result in the loss of agricultural land and holdings and of ecological habitat, including the southern part of Lionlodge Covert local wildlife site (LWS). There would be an impact on the historic landscape character in the area and on the setting of Ingestre Conservation Area (including Ingestre parkland) and a small number of listed buildings. The route would cross an historic landfill in the location of Staffordshire County Showground which would present a risk of contamination. There would also be potential impacts on a number of watercourses and tributaries and the need to divert/realign local roads and PRoW could result in increased journey times and delay. This option would impact on a strategic residential development site, between Hopton and Marston, identified within the adopted Plan for Stafford Borough 2014.

2.5.46 This option is located approximately 700m from the Hopton Heath Registered Battlefield and 900m from Pasturefields SAC and SSSI.

2.5.47 Option B5-7.1 does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option B5-7.0

2.5.48 In comparison to Option B5-7.1 (the Proposed Scheme), Option B5-7.0 is located closer to the Showground, requiring demolition of a building within Staffordshire County Showground, thereby increasing the number of demolitions. The loss of part of the Staffordshire County Showground may affect the viability of some of the businesses located with the showground and events at this location. There would be an increase in noise and visual impacts upon properties between Hopton and Yarlet. This option would impact on a strategic residential development site, between Hopton and Marston, identified within the adopted Plan for Stafford Borough 2014. This option is located approximately 650m from the Hopton Heath registered battlefield and 900m from Pasturefields SAC and SSSI.

2.5.49 Option B5-7.0 does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option B5-7.2a

2.5.50 In comparison to Option B5-7.1 (the Proposed Scheme), Option B5-7.2a would require significantly more land during construction and would result in increased temporary historic setting, landscape, visual and noise impacts during construction. Once constructed, this option would reduce impacts on the historic landscape and on the settlements of Hopton, Marston and Yarlet. There would be significant noise benefits from the route being in tunnel at Hopton, where noise impacts would be removed; but noise impacts would remain largely unchanged elsewhere. The bored tunnel would pass beneath the historic landfill in the location of Staffordshire County Showground avoiding the risk of contamination. There would be a slight reduction in the number of properties requiring demolition, and avoidance of the Staffordshire County Showground. Impacts on agricultural land and holdings would be reduced as would

traffic impacts, as there would be less severance of Hopton, fewer impacts on the A518 Weston Road and a reduced need to temporarily divert PRoW. The large cutting at the B5066 Sandon Road would introduce significant flood risk due to the large existing surface water flow path and tunnelling through this area and would increase the risk to groundwater resources. This option would impact on a strategic residential development site, between Hopton and Marston, identified within the adopted Plan for Stafford Borough 2014. This option is located approximately 650m from the Hopton Heath registered battlefield and 900m from Pasturefields SAC and SSSI.

2.5.51 The volume of material being removed for the tunnel and the corresponding traffic movements would be greater than Option B5-7.1. The tunnel through this area would also increase the risk to groundwater resources. This option introduces significantly greater technical and construction complexities than Option B5-7.1, which would also increase the construction risks and lengthen the construction programme.

Option B5-7.3a

2.5.52 In comparison to Option B5-7.1 (the Proposed Scheme), Option B5-7.3a would result in the partial loss of Hopton Heath registered battlefield, a designated heritage asset, and the setting of the remaining area of the battlefield would be impacted. There would also be a visual impact on the Capability Brown landscape lying to the north-west of Ingestre Hall. This option would be approximately 50m south of Pasturefields SAC and SSSI, significantly closer than Option B5-7.1. The brine flow feeding Pasturefields SAC and SSSI is from the north, rather than the south. However, due to the proximity of Pasturefields at this location, there could be a potential risk for increased flood waters (freshwater) during a flood event, which could alter the salinity of the water that supports Pasturefields SAC and SSSI saltmarsh vegetation. Visual and noise impacts would additionally be introduced on residential properties at Little Ingestre resulting from the shift in the alignment, and the increased length of the viaduct crossing the Macclesfield to Colwich Line, the Trent and Mersey Canal and the River Trent.

2.5.53 In comparison with Option B5-7.1, Option B5-7.3a would result in a significant reduction in the number of residential and commercial properties requiring demolition, and the loss of Ingestre Park Golf Club would be avoided. Land required within the Staffordshire County Showground would also be reduced, so the businesses located within it would be unaffected. This option would significantly reduce visual and noise impacts to Moreton House and Moreton Grange, and would maintain the setting of these buildings, and others in close proximity, including Ingestre Conservation Area. The realignment of the route would be further north from Hopton, Marston and Yarlet and therefore would result in significantly reduced visual, noise and amenity impacts on residential properties. This option would also reduce the impacts on agricultural land and holdings and the historic link between Ingestre and Tixall parks would be maintained. This option would avoid any impact on a strategic residential development site, between Hopton and Marston, identified within the adopted Plan for Stafford Borough 2014, as the option would run to the north-east.

2.5.54 Option B5-7.3a does not introduce any technical or construction complexities, risk of safety hazards or lengthening of the construction programme.

Option B5-7.3b

2.5.55 Compared to Option B5-7.1 (the Proposed Scheme), Option B5-7.3b would require significantly more land during construction. It would also result in an increase in historic setting, landscape, visual and noise impacts during construction, compared to Option B5-7.1. There would be a partial loss of Hopton Heath registered battlefield (albeit less than Option B5-7.3a), which would impact on the setting of the remaining area of the battlefield, and the Capability Brown landscape lying to the north-west of Ingestre Hall, and the rural setting of Salt. As with Option 5-7.3a, the viaduct over the Macclesfield to Colwich Line and the River Trent would increase the impact on the setting of the area. This option would be approximately 50m south of Pasturefields SAC and SSSI, which is significantly closer than Option B5-7.1. The brine flow feeding Pasturefields SAC and SSSI is from the north, rather than the south. However, due to the proximity of Pasturefields at this location, there could be a potential risk for increased flood waters (freshwater) during a flood event, which could alter the salinity of the water that supports Pasturefields SAC and SSSI saltmarsh vegetation. This option would increase the visual and noise impacts on residential properties at Little Ingestre.

2.5.56 This option would significantly reduce visual and noise impacts and marginally reduce the number of properties requiring demolition. This option would remove visual and noise impacts at Moreton House and Moreton Grange. Ingestre Park Golf Club would be avoided and the amount of land required permanently within the Staffordshire County Showground would be reduced. Once constructed, this option would reduce impacts on the settlements of Hopton, Marston and Yarlet. There would be significant reductions, and removal of impact on the setting of a number of listed buildings and the Ingestre Conservation Area. The historic link between Ingestre and Tixall parks would be maintained. This option would reduce the impacts on agricultural land and holdings. Impacts on highways would be reduced, as there would be less severance of Hopton, fewer impacts on the A518 Weston Road and a reduced need to temporarily divert PRoW. This option would avoid any impact on a strategic residential development site, between Hopton and Marston, identified within the adopted Plan for Stafford Borough 2014, as the option would run to the north-east.

2.5.57 The volume of material being removed for the tunnel and the corresponding construction traffic movements would be greater than Option B5-7.1. The tunnel through this area would also increase the risk to groundwater resources. This option introduces significantly greater technical and construction complexities than Option B5-7.1, which would also increase the construction risks and lengthen the construction programme.

Option B5-7.4b

2.5.58 In comparison to Option B5-7.1 (the Proposed Scheme), Option B5-7.4b would result in significantly more land temporarily. It would also result in significantly increased historic setting, landscape, visual and noise effects during construction. With this option, there would be an impact on the setting of Hopton Heath registered battlefield and the lengthening of the viaduct over the Macclesfield to Colwich Line and River Trent would also increase the impact on the setting of the area. The route would be approximately 50m south of Pasturefields SAC and SSSI, which is significantly closer than Option B5-7.1. The brine flow feeding Pasturefields SAC and

SSSI is from the north, rather than the south. However, due to the proximity of Pasturefields at this location, there could be a potential risk for increased flood waters (freshwater) during a flood event, which could alter the salinity of the water that supports Pasturefields SAC and SSSI saltmarsh vegetation.

2.5.59 Compared to Option B5-7.1, Option B5-7.4b would increase the impacts on agricultural land and holdings and as the route would be significantly closer to Salt, would potentially result in visual and noise impacts on residential properties. The area around Salt is a proposed MSA, and this option would result in a severance of mineral resources. Transport impacts would also be introduced on Salt Road and Church Lane.

2.5.60 Option B5-7.4b would reduce visual and noise impacts and marginally reduce the number of properties requiring demolition. This option would remove visual and noise impacts at Moreton House and Moreton Grange. Ingestre Park Golf Club would be avoided and the amount of land required permanently within the Staffordshire County Showground would be reduced. This option would remove the impact on the setting of a number of listed buildings and the Ingestre Conservation area. The historic link between Ingestre and Tixall parks would be maintained. This option would reduce the impacts on agricultural land and holdings. This option would avoid any impact on a strategic residential development site, between Hopton and Marston, identified within the adopted Plan for Stafford Borough 2014, as the option would run to the north-east.

2.5.61 The volume of material being removed for the tunnel and the corresponding traffic movements required would be greater than Option B5-7.1. The tunnel through this area would also increase the risk to groundwater resources. This option introduces significantly greater technical and construction complexities than Option B5-7.1, which would also increase the construction risks and lengthen the construction programme.

3 Stakeholder engagement and consultation

3.1 Introduction

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

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

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

3.2 Key stages of Phase 2a engagement and consultation

Summary of engagement

3.2.1 A summary of engagement undertaken or underway since the route announcement in November 2015 is provided in Table 7.

Table 7: Mechanisms and timeline of stakeholder engagement and consultation since the route announcement in November 2015

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

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

Property consultation

3.2.2 Property consultation focused on those individuals and landowners potentially directly affected by the Proposed Scheme. The consultation took place between 30 November 2015 and 25 February 2016. Its purpose was to inform the Government's decision on whether to implement the same compensation and assistance schemes as for Phase One, taking into consideration the views of those individuals and organisations who expressed their opinions on the proposals.

3.2.3 Within the Colwich to Yarlet area, a property consultation event was held at Stafford Gatehouse Theatre on 20 January 2016 and Colwich and Little Haywood Village Hall on 22 January 2016.

3.2.4 Consultation responses were analysed, and reported on 26 May 2016 in the Government's report entitled "HS2 Phase Two: West Midlands to Crewe Property Consultation 2015"[23]. The Government's response was issued in the Decision Document "HS2 Phase Two: West Midlands to Crewe Property Consultation 2015"[24].

EIA SMR consultation

3.2.5 The draft EIA Scope and Methodology Report (SMR) was formally consulted on from 8 March to 13 May 2016 and was issued to statutory bodies, non-government organisations and local authorities. It was also available on the Government's website, allowing comment by local interest groups and the public. Twenty-six responses to the draft EIA SMR were received, as a result of which changes were made to the EIA SMR, which was published in September 2016. The changes between the draft EIA SMR and publication of the EIA SMR were set out in the EIA SMR Consultation Summary Report[25], also published in September 2016.

3.2.6 The assessment set out in this ES follows the scope and methodology in the EIA SMR and SMR Addendum (Volume 5: CT-001-001 and CT-001-002).

Working draft EIA Report consultation

3.2.7 The working draft EIA Report was formally consulted upon between 13 September and 7 November 2016. Parallel consultations on the working draft EQIA and Design Refinements were also undertaken during this period. As part of the process of

[23] UK Government: HS2 Phase 2a: HS2 Phase Two: West Midlands to Crewe Property Consultation 2015. Available online at: https://www.gov.uk/government/consultations/hs2-phase-two-west-midlands-to-crewe-property-consultation-2015
[24] UK Government: HS2 Phase 2a: HS2 Phase Two West Midlands to Crewe property consultation 2015: government decision. Available online at: https://www.gov.uk/government/publications/hs2-phase-two-west-midlands-to-crewe-property-consultation-2015-government-decision
[25] UK Government: HS2 Phase 2a: West Midlands to Crewe Draft Environmental Impact Assessment Scope and Methodology Report consultation. Available online at: https://www.gov.uk/government/consultations/hs2-phase-two-west-midlands-to-crewe-draft-environmental-impact-assessment-scope-and-methodology-report-consultation

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

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

3.2.9 These responses were analysed and the following themes and issues relevant to Colwich Yarlet area included:

- ecological impacts including impacts on Pasturefields SAC and SSSI;
- impacts on the communities at Marston and Hopton, including maintaining pedestrian access at Hopton;
- noise and visual impacts associated with the height of the Proposed Scheme, in particular in relation to the Great Haywood viaduct;
- impacts on the communities at Ingestre and Tixall;
- impacts on Shugborough Hall and Park;
- impacts on Great Haywood Marina;
- impact on Upper Moreton Farm Community Interest Company (CIC);
- use of the local road network for construction traffic;
- impacts on Ingestre Park Golf Club; and
- impacts on Yarlet School.

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

3.2.11 A Working Draft Environmental Impact Assessment Report: Consultation Summary Report[26] has been published alongside this ES summarising how the responses to the working draft EIA Report have been taken into consideration in the design and assessment of the Proposed Scheme. A separate consultation summary report has been prepared for the working draft EQIA Report[27].

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

3.3 Engagement and consultation with stakeholder groups

Technical and specialist groups

3.3.1 Engagement has been undertaken with technical and specialist organisations to provide appropriate specialist input to inform the design and assessment of the

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

Proposed Scheme. This includes engagement with statutory bodies, local authorities and utility companies operational within the Colwich to Yarlet area.

3.3.2 Direct engagement with county and borough councils within the Colwich to Yarlet area took place in order to collate local baseline information, identify and understand issues and concerns, and provide a mechanism for ongoing dialogue and discussion on the assessment and design development.

3.3.3 Engagement has focused on the technical areas that inform the assessment, including, landscape and visual, sound, noise and vibration and traffic and transport, amongst others topics. It has also informed the design of the Proposed Scheme, as summarised in Table 8.

3.3.4 Briefings were offered to specialist and technical stakeholders along the route of the Proposed Scheme during the period of consultation on the working draft EIA Report to provide information on the evolving design and assessment of the Proposed Scheme in their respective areas.

3.3.5 Table 8 includes engagement undertaken with technical and specialist groups and how this has informed the design and assessment of the Proposed Scheme in the Colwich to Yarlet area.

Table 8: Engagement to date with technical and specialist groups

Stakeholder	Area of focus for design and assessment	How this has informed the design and assessment of the Proposed Scheme
Statutory		
Department for Environment, Food and Rural Affairs (Defra)	Agricultural and land quality issues	Identifying local agricultural and land quality issues, including sites of particular interest such as foot and mouth burial sites.
Canal & River Trust	The landscape and visual assessment methodology with specific reference to the selection and location of representative viewpoints for the assessment and for photomontages.	Additional viewpoints and photomontages were identified at Great Haywood Marina, to create a set of sequential viewpoints to understand the potential impact of the construction and operation of the Proposed Scheme on sensitive receptors such as towpath and narrowboat users, informing the development of mitigation landscape design with regard to the viaduct abutments and embankments in particular.
Environment Agency	Water and flood risk issues	Providing information on water and flood risk issues along the line of route.
Food and Environment Research Agency (FERA)	Land contamination issues	Identification of local land quality issues.
Forestry Commission	Ecology and landscape related issues	Informing understanding of methodological approach and detailed local conditions and factors to be taken into consideration in the assessment.
Highways England	Traffic and transport assessment	Informing the assessment of road network capacity and identification of proposed future works.
Historic England	Nationally designated heritage assets and the heritage assessment methodology.	Informing the methodology for assessing setting and impacts on historic landscape at national and regional level. Identification and assessment methodology of designated and non-designated heritage assets with particular focus on Ingestre

Stakeholder	Area of focus for design and assessment	How this has informed the design and assessment of the Proposed Scheme
		Hall, Ingestre Park, Tixall and Shugborough Hall and Moreton House
Natural England	Ecology and landscape and visual related issues Agricultural land quality and land restoration issues	Providing further information regarding potential ancient woodland sites. Understanding of methodological approach and detailed local conditions and factors to be taken into consideration in the assessment.
Local authorities		
Staffordshire County Council	Cultural heritage issues	Identifying heritage assets to protect these assets and their settings.
	Water and flood risk issues	Understanding local infrastructure and conditions, including flood risks.
	Ecology and biodiversity issues	Understanding sensitive ecological sites and appropriate mitigations and compensation for habitat loss associated with the Proposed Scheme.
	Traffic and transport in relation to the construction of the Proposed Scheme	Understanding the local road network, its current use and levels of traffic and congestion to inform construction traffic routes.
	Landscape and visual effects of the Proposed Scheme	Identifying representative viewpoint and photomontages locations.
	Potential health effects of the Proposed Scheme on local communities	Understanding local demographic and determinants of health and wellbeing.
	Equality, health and community assessments	Identifying vulnerable groups within the community area.
	Air quality assessment	Understanding local conditions and factors to inform scheme design and EIA.
	Sound noise and vibration assessment	Understanding local conditions and factors to inform scheme design and EIA.
Stafford Borough Council	Equality, health and community assessments	Identifying vulnerable groups within the community area.
	Land quality assessment	Identifying key sites within the local area to be included in the land quality assessment.
Utilities		
National Grid	Utilities, gas and electricity networks	Informing route-wide considerations around utilities network and factors to be considered in the design and assessment of the Proposed Scheme.
Severn Trent Water	Potential connections and proximity of the Proposed Scheme to Severn Trent Water assets.	Understanding of local utilities and factors to consider in the design, construction and operation of the Proposed Scheme, in particular the Milford and Shugborough ground water abstraction sites and Source Protection Zones.
Other specialist stakeholders		
Central Association of Agricultural Valuers (CAAV)	Potential impacts of the Proposed Scheme on agricultural businesses.	Understanding the concerns of the agricultural industry in relation to the Proposed Scheme.

Stakeholder	Area of focus for design and assessment	How this has informed the design and assessment of the Proposed Scheme
Country Land and Business Association (CLA)	Potential impacts of the Proposed Scheme on agricultural businesses	Understanding the concerns of the agricultural industry in relation to the Proposed Scheme.
Landmark Trust	Potential impacts on Ingestre Pavilion.	Informing understanding of local historic and cultural heritage assets, in particular, Ingestre Pavilion.
National Farmers Union (NFU)	Potential impact of the Proposed Scheme on farmers and agricultural businesses	Understanding the concerns of farmers affected by the Proposed Scheme.
National Trust	Shugborough Hall and wider historic and cultural heritage issues.	Informing understanding of local historic and cultural heritage assets, in particular, Shugborough Hall.
Royal Society for the Protection of Birds (RSPB)	Ecology and biodiversity issues	Informing the ecology survey programme, and strategic mitigation opportunities.
Staffordshire Wildlife Trust	Local and regional ecology and biodiversity issues	Understanding of local wildlife assets and informing potential off site and strategic mitigation.
The Cannock Chase Area of Outstanding Natural Beauty Unit	Viewpoints in relation to the landscape and visual impact assessment.	Understanding the functionality of the site and understanding viewpoints which may be impacted by the Proposed Scheme.
Woodland Trust	The route and associated effects to local woodland habitats	Informing understanding of local woodland habitats and how to mitigate and offset impacts to these.

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

Communities

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

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

3.3.9 In the Colwich to Yarlet area, consultation events on the working draft EIA Report, working draft EQIA Report and on key design refinements were held at:

- Great Haywood Memorial Hall on 7 October 2016; and
- Stafford Gatehouse Theatre on 10 October 2016.

3.3.10 HS2 Ltd staff and consultants attended the events, including engineers, environmental and property specialists, for members of the public to speak to.

3.3.11 An overview of how these responses have been taken into consideration in the ES is contained in the working draft EIA Consultation Summary Report[26].

3.3.12 Engagement has also been undertaken with members of the community via the local parish councils and residents, as outlined in Table 9. Engagement with parish councils and residents has been used to understand local community concerns and issued in relation to the Proposed Scheme.

3.3.13 Table 9 sets out meetings undertaken with community stakeholders in the Colwich to Yarlet area.

Table 9: Meetings held with communities and community stakeholders

Stakeholder	Area of focus	How this has informed the design and assessment of the Proposed Scheme
Colwich Parish Council	To provide an update on the Proposed Scheme and discuss the working draft EIA, EQIA and Design Refinement consultation documents and understand the local conditions and factors to inform scheme design and EIA.	Understanding local conditions and factors to inform scheme design and EIA.
Ingestre with Tixall Parish Council		
Marston Parish Meeting		
Residents of Ingestre and representatives of Ingestre Residential Arts Centre and St Mary's Church.	The cultural heritage value of Ingestre Hall and the surrounding heritage buildings as well as the functionality of the site. The purpose of the visit was to understand the importance of Ingestre Residential Arts Centre as an educational resource.	Understanding concerns regarding the potential impacts of the Proposed Scheme on Ingestre's heritage buildings.

Directly affected individuals, landowners and businesses

3.3.14 Engagement was undertaken with land owners, whose operations, land and/or property will be directly affected by the Proposed Scheme whether permanently or temporarily. This included individual property and land owners, commercial and educational entities, and farmers and growers, including through the land and property consultation and ongoing dialogue.

3.3.15 Key commercial and educational landowners engaged within the Colwich to Yarlet area include: Ingestre Park Golf Club; Staffordshire County Showground; Great Haywood Marina; Upper Moreton Farm; and The Priory Group with regard to Mayfield Children's Home[28]. Ongoing dialogue continues with these stakeholders to understand their specific issues in relation to the Proposed Scheme.

3.3.16 Thirty-eight visits were undertaken to farmers and growers in this area during the assessment and design development. Engagement was also carried out with key representatives of the farmers and growers industry.

3.3.17 Key areas of focus for the engagement with landowners and their representatives were the refinement of locations of balancing ponds, access roads and environmental

[28] Mayfield Children's Home is the residential arm of Rugeley School, located in the Fradley to Colton area (CA1).

mitigation, the design of access and accommodation bridges, and maintaining operational access to land and businesses.

4 Agriculture, forestry and soils

4.1 Introduction

4.1.1 This section provides a description of the current baseline for agriculture, forestry and soils and the likely impacts and significant effects of the construction and operation of the Proposed Scheme within the Colwich to Yarlet area. Consideration is given to the extent and quality of the soil and land resources underpinning the primary land use activities of farming and forestry, and the physical and operational characteristics of enterprises engaged in these activities. Consideration is also given to diversification associated with the primary land uses, and to related land-based enterprises, notably equestrian activities.

4.1.2 Engagement with farmers and landowners has been undertaken. The purpose of the engagement has been to obtain baseline information on the scale and nature of the farm and forestry operations and related farm-based uses, and to provide farmers and landowners with the opportunity to raise issues and discuss mitigation in relation to the Proposed Scheme. Engagement undertaken with farmers and landowners will be documented in a farm pack for each farm holding[29].

4.1.3 Details of published and publicly available information used in the assessment, and the results of surveys undertaken within this area, are contained in Volume 5: Appendix AG-001-002 and shown on Map Series AG-01 (Agricultural Holdings), AG-02 (Soil Associations) and AG-04 (Agricultural Land Classification) (Volume 5: Agriculture, forestry and soils Map Book).

4.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

4.2 Scope, assumptions and limitations

4.2.1 The assessment scope, key assumptions and limitations for the agriculture, forestry and soils assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)[30], and the SMR Addendum[31].

4.2.2 The study area for the agriculture, forestry and soils assessment covers all land required for the construction and operation of the Proposed Scheme. The resources and receptors that are assessed within this area are agricultural land, forestry land and soils, together with farm and rural holdings. The assessments of the impacts on agricultural land quality and forestry land are made with reference to the prevalence of best and most versatile (BMV) land and forestry land in the general locality, taken as a 4km corridor centred on the route of the Proposed Scheme.

4.2.3 The quality of agricultural land in England and Wales is assessed according to the Agricultural Land Classification (ALC)[32] system, which classifies agricultural land into

[29] Part 3 of the HS2 Phase 2a Guide for Farmers and Growers, Available online at: www.gov.uk/hs2
[30] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[31] Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.
[32] Ministry of Agriculture, Fisheries and Food (1988), Agricultural Land Classification of England and Wales – Revised guidelines and criteria for grading the quality of agricultural land.

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

4.2.4 Forestry is considered as a land use feature, and the impacts have been calculated quantitatively. The qualitative effects on forestry land and woodland are addressed principally in Section 8, Ecology and biodiversity, and Section 11, Landscape and visual.

4.2.5 Soil attributes, other than for food and biomass production, are identified in this section, but the resulting function or service provided is assessed in other sections, notably Section 7, Cultural heritage; Section 8, Ecology and biodiversity; Section 11, Landscape and visual; and Section 15, Water resources and flood risk. The function of soil as a carbon store is described in Volume 3: Route-wide effects (Section 4).

4.2.6 The main issue for farm holdings is disruption by the Proposed Scheme of the physical structure of agricultural holdings and the operations taking place upon them, during both construction and operational phases.

4.2.7 Common assumptions that have been used in assessing the effects of the Proposed Scheme are set out in Volume 1 (Section 8). These assumptions include the restoration of agricultural land that is required temporarily for construction to agricultural use, and the handing back of land used temporarily to the original landowner. It is also assumed that capital items demolished will not be replaced as replacement assets are not included in the Proposed Scheme and will ultimately be at the discretion of the landowner. In the majority of cases, the details of land use have been obtained from face-to-face interviews. Where this has not been possible, holding data has been obtained from publicly available sources.

4.3 Environmental baseline

Existing baseline

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

Soil and land resources

Geology and soil parent materials

4.3.2 A full description of the geological characteristics of the Colwich to Yarlet area is provided in Section 10, Land quality and Section 15, Water resources and flood risk, and shown on Map WR-02-202 (Volume 5: Water resources and flood risk Map Book). The principal bedrock geology mapped by the British Geological Survey (BGS)[33] is that of the Mercia Mudstone Group, comprising mudstone with subordinate siltstone, with some halite-bearing units and sandstone. Rocks of the Sherwood Sandstone Group

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

are present around Hopton and Salt, and typically comprise pebbly red, brown and grey sandstone and conglomerate interbedded with red and brown siltstones and mudstones. The Stafford Halite Member is mapped to the north of Yarlet and comprises structureless mudstone with halite (rock salt).

4.3.3 Deposition of Glacial Till over the mudstone occurs across the valley sides to the east of Great Haywood, across a plateau east of Hopton, and on higher ground in the north of the study area. These deposits generally comprise unsorted material ranging in size from clay to boulders (hence it is also commonly referred to as Boulder Clay).

4.3.4 On the valley floor and lower valley slopes west of Great Haywood, the deposits overlying both the Mercia Mudstone Group and the Sherwood Sandstone Group are of glaciofluvial origin. River Terrace Deposits are mapped on the footslopes to the valley of the River Trent and are dominated by sand and gravel. Glaciofluvial Sheet Deposits, comprising sand and gravel, are present around Tixall, Hopton and along the River Trent valley.

4.3.5 Within the main channel of the River Trent, superficial Alluvium deposits overlie the Mercia Mudstone Group in the River Trent valley, and typically comprise consolidated silty clay, silt, sand, peat and gravel.

Topography and drainage

4.3.6 The main topographical and drainage feature in this area is the River Trent and its valley. In the south, between Colwich and Great Haywood, topography is complex, with a series of irregular slopes, ridges and terraces at altitudes of between 80m and 125m above Ordnance Datum (AOD). Two shallow south facing valleys are cut into the hillsides in the vicinity of Coley, draining the land south towards the River Trent beyond Colwich and Little Haywood. North-west of Coley, the altitude falls from around 125m to 80m AOD down to the valley floor of the River Trent (and the Trent and Mersey Canal) at Great Haywood.

4.3.7 The remainder of the study area is characterised by a series of elongated ridges and more rounded summits with shallow to moderate irregular slopes, which drain the land northward to the River Trent and southward to the Marston Brook.

4.3.8 The greatest flood risk in the study area is within the Trent Valley to the west of Great Haywood. The low-lying land is classified as Flood Zone 3 in which there is a 1 in 100 year or greater annual probability of flooding. Further details are provided in Section 15, Water resources and flood risk.

Description and distribution of soil types

4.3.9 The characteristics of the soils are described by the Soil Survey of England and Wales[34] and shown on the National Soil Map[35]. The soils are grouped into associations of a range of soil types. They are described in more detail in Volume 5: AG-001-002 and their distribution is shown on Map AG-02-102 (Volume 5: Agriculture, forestry and soils Map Book).

[34] 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.
[35] Cranfield University (2001), *The National Soil Map.*

4.3.10 There are three groups of soil associations in this study area. The presence of each group has been confirmed by detailed soil survey data obtained from published survey records and surveys undertaken for the purpose of this assessment. The main group is developed in Mercia Mudstone, and comprises clay loam, silty clay loam or sandy clay loam topsoils over clay loam or clay subsoils. This group includes the Flint, Whimple 3, Clifton and Worcester associations. Soil profiles in these associations are mostly imperfectly drained (Wetness Class[36] (WC) III) or, occasionally, as in the Clifton association, poorly drained (WC IV). Soil survey data from within the Trent Valley at Colwich identifies profiles with slightly higher silt contents, comprising sandy silt loam, clay loam and silty clay loam topsoils, overlying slowly permeable clay loam or silty clay subsoils, which are imperfectly drained (WC III).

4.3.11 The remaining groups are subordinate. One of these subordinate groups comprises clayey and peaty profiles of the Midelney association, which are poorly or very poorly drained (WC IV or V), developed in Alluvium deposits and closely associated with the River Trent. This soil type has been identified within the flood plain and includes black medium clay loam topsoil overlying malodorous, greenish grey clay subsoil, affected by groundwater.

4.3.12 The remaining group comprises the shallow, sandy loam profiles of the Bromsgrove association derived from the sandstone bedrock and the Wick association soils, which are derived from glaciofluvial and terrace drift, both of which are mainly well drained (WC I). The topsoil is of clay loam or sandy loam and predominantly overlies sandy loam subsoils, with rare occurrences of loamy sand and clay loam. Soil survey data shows some variability in these soils, particularly in respect of stone content.

Soil and land use interactions

Agricultural land quality

4.3.13 The principal soil/land use interaction is the quality of the agricultural land resource. The ALC is based on the identification of physical limitations to the agricultural capability of land resulting from the interactions of soil, climate and the study area.

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

4.3.15 Climate within this study area does not in itself place any limitation on agricultural land quality. However, the interactions of climate with soil characteristics are important in determining the wetness and droughtiness[37] limitations of the land.

4.3.16 The local agro-climatic data have been interpolated from the Meteorological Office's standard 5km grid point dataset[38] for four points within the area and are set out in Volume 5: Appendix AG-001-002. The data show climate in the area to be moderately cool and moist. The number of Field Capacity Days (FCDs), when the soil moisture

[36] 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 WC I which is well drained to WC VI which is very poorly drained.
[37] 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.
[38] Meteorological Office (1989), *Gridpoint Meteorological data for Agricultural Land Classification of England and Wales and other Climatological Investigations*.

deficit[39] is zero, ranges from 178 to 182 days per annum. This is higher than average for lowland England (150 days) and generally constrains agricultural cultivations and soil handling for relatively long periods over winter. Soil moisture deficits, which give an indication of the liability of soils to droughtiness in summer, are typically moderate.

4.3.17 Site factors include gradient and microrelief, though these are not limiting to agricultural land quality in this study area. Flooding of low lying land can be a limitation to agricultural land quality, particularly to the west of Great Haywood, within the River Trent valley and this limits land quality to Subgrade 3b and Grade 4. Further details are provided in Section 15, Water resources and flood risk.

4.3.18 The main physical limitations that result from interactions between soil, climate and site factors are soil wetness, soil droughtiness and a localised susceptibility to erosion. For soil wetness, each soil can be allocated a Wetness Class based on soil structure, evidence of waterlogging and the number of FCDs. The topsoil texture then determines its ALC grade. Soil droughtiness is determined by the soil textures and thickness of each soil horizon present, together with the crop moisture deficits.

4.3.19 Soils within the main group of associations present in the study area (the Flint, Whimple 3, Clifton and Worcester associations) comprise imperfectly drained profiles of WC III with medium loamy topsoils. These are limited by wetness and workability to Subgrade 3a; where the topsoils have heavier loamy topsoils they are limited to Subgrade 3b. Poorly drained profiles of WC IV with medium loamy topsoils are classified as Subgrade 3b; whilst those with heavier loamy topsoils are Grade 4.

4.3.20 The second soil type, the Midelney association, comprising poorly or very poorly drained clayey profiles are limited severely by soil wetness and difficult workability, and classified as Grade 4.

4.3.21 The well drained, coarse, sandy Bromsgrove and Wick soils are affected slightly by soil droughtiness. Bromsgrove soils are described by the Soil Survey of England and Wales as giving rise to some of the best agricultural land in the region, and are generally considered to be no worse than Grade 2. Available soils data shows the limitation to be variable in this soil type, with Grade 2 to the north of Stafford, Subgrade 3a to the north-east of Stafford, and with localised stoniness resulting in a more severe limitation to Subgrade 3b where land is also moderately droughty.

4.3.22 As set out in the SMR, the sensitivity of BMV land in the study area is determined relative to the abundance of such land in the area, set as a 4km corridor centred on the route of the Proposed Scheme. Department for the Environment, Food and Rural Afairs (Defra) mapping[40] shows that there is a high likelihood of encountering BMV agricultural land in the locality, which makes such land a resource of low sensitivity in this study area.

[39] The moisture deficit is a crop-related meteorological variable which represents the balance between rainfall and potential evapotranspiration calculated over a critical portion of the growing season.
[40] Defra (2005), *Likelihood of Best and Most Versatile Agricultural Land*.

4.3.23 The distribution of agricultural land quality in the study area is described in more detail in Volume 5: AG-001-002 and shown on Map AG-04-105b to Map AG-04-109a (Volume 5: Agriculture, forestry and soils Map Book).

Other soil interactions

4.3.24 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[41] and the Government's White Paper, The Natural Choice: securing the value of nature[42], and include:

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

4.3.25 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.

4.3.26 The floodplain of the River Trent occupies land where water has to flow or be stored in times of flood, as set out in Section 15, Water resources and flood risk. The soils in this area function as water stores for flood attenuation, as well as providing ecological habitat.

Land use

Land use description

4.3.27 Agricultural land use in this study area is mixed combinable arable and pasture, with most of the pasture used for dairy and beef cattle enterprises; sheep flocks are 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 near Little Haywood and Ingestre, with other non-agricultural uses being the Ingestre Park Golf Club, Great Haywood Marina and the Staffordshire County Showground.

4.3.28 Woodland is predominantly found in the centre of the study area around Ingestre and includes Lionlodge Covert, which extends to approximately 16.9ha of deciduous woodland, and Lambert's Coppice, which extends to approximately 14.1ha of deciduous woodland. Neither is known to be actively managed for timber production.

[41] Defra (2009), *Soil Strategy for England.*
[42] HM Government (2011), *The Natural Choice: securing the value of nature.*

Upper Hanyards Farm has four small woodland plantations (each approximately 0.4ha), which are managed for timber production, as well as providing cover for gamebirds. There are occasional blocks of woodland throughout the study area, including Spencer's Plantation, Little Covert and Tithebarn Covert in the south and The Grove in the north. A full description of woodland in the Colwich to Yarlet area is set out in Section 8, Ecology and biodiversity.

4.3.29 The proportion of woodland as a land use in the general locality, taken as a 4km corridor centred on the route of the Proposed Scheme, is 6.2%, which is below the national average of 10%. Woodland as a land use is therefore a resource of medium sensitivity in this study area.

4.3.30 A number of environmental designations potentially influence land use within the study area. The whole area is a nitrate vulnerable zone, where statutory land management measures apply that seek to reduce nitrogen losses from agricultural sources to water.

4.3.31 Some agricultural land is also subject to agri-environment management prescriptions that seek to retain and enhance the landscape and biodiversity qualities and features of farmland. These are associated with the Environmental Stewardship Scheme (the Entry Level Scheme (ELS) or Higher Level Scheme (HLS)), or the Countryside Stewardship Scheme (CSS), which since 2015 is the main agri-environment scheme in England. The CSS incorporates elements of Environmental Stewardship, the English Woodlands Grant scheme and Catchment Sensitive Farming grants.

4.3.32 Most Environmental Stewardship agreements, which were extensive and covered approximately 70% of agricultural land in England, have now ended although existing agreements will run their course. The CSS is more focused than Environmental Stewardship, with applications for funding being competitive and the area covered by the scheme less than that covered under Environmental Stewardship. Holdings that have land entered into an agri-environment scheme are identified in Table 10.

Number, type and size of holdings

4.3.33 Table 10 sets out the main farm holdings within this study area.

4.3.34 There is a mixture of owner-occupation and tenancies, which range from individual grazing fields and small holdings to large farms of over 500ha. Staffordshire County Council (SCC) has a sizeable land holding towards the northern end of the area where there are a number of County Council tenanted farms. There are also several smaller, less commercial holdings within the study area, which likely reflects the urban-fringe nature of the setting (on the edge of Stafford) and the competition for agricultural land and dwellings between non-agricultural occupiers and farmers. The boundaries of the holdings are shown on Maps AG-01-105b to AG-01-109a (Volume 5: Agriculture, forestry and soils Map Book) along with the location of the main farm buildings. Field drainage is common throughout the area.

4.3.35 Table 10 also sets out the sensitivity of individual holdings to change. This is determined by the extent to which they have the capacity to absorb or adapt to impacts, which in turn is determined primarily by their nature and scale. In general terms, larger holdings have a greater capacity to change enterprise mix and scale, can better absorb impacts and are less sensitive. Units that rely on the use of buildings

(such as intensive livestock and dairy farms, and horticultural units) are less able to accommodate change and have a higher sensitivity. Non-commercial land uses and units, such as pony paddocks associated with residential properties, have a low sensitivity. The holding reference provides a unique identifier and relates to Maps AG-01-105b to AG-01-109a (Volume 5: Agriculture, forestry and soils Map Book) and Volume 5: Appendix AG-001-002.

Table 10: Summary characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
CA2/1 Upper Moreton Farm	Beef cattle and sheep, small bale hay sales	24	Educational access farm for schools and groups	HLS for species rich grassland and ridge-and-furrow grassland; other ELS	Medium
CA2/2 Moreton Farm	Arable	107	None	ELS	Medium
CA2/3 Woodruff Barn	Residential with equestrian	2	None	None	Low
CA2/4* Land at Moreton Grange	Non-commercial equestrian	1	Not known	None	Low
CA2/5 Bottom End Cottage	Residential with equestrian	2	None	None	Low
CA2/6 Moreton House Farm	Arable and beef cattle	136	Arable contracting, fishing pond, wind turbine	ELS and HLS	Medium
CA2/7 Tithebarn Farm	Arable and store cattle	162	On-farm shoot	Unknown	Medium
CA2/8 Far Coley Farm	Beef cattle	61	Bed and breakfast and holiday cottages, caravan storage, rent of hobby-use facilities and buildings	None	Medium
CA2/9 Farley Farm	Beef cattle, sheep, ponies	57	Farmhouse rented out, 4ha grassland rented out, DIY and full livery	None	Medium
CA2/10 Land at Tolldish Lane	Grassland (let)	2	None	None	Low
CA2/11 Avondale	Grassland used for hay making	3	Non-commercial breeding of rabbits	None	Low
CA2/12 The Green Barn	Sheep and ponies	15	Farriery	None	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
CA2/13 Tixall Lodge Estate	Dairy, beef cattle, sheep	300 plus 1,800ha shooting rights on other's land	Managed shoot	None	Medium
CA2/14* Land west of A51 Lichfield Road, Lichfield	Grassland	2	Not known	None	Low
CA2/15* Land south of Hoo Mill Lane	Grassland	4	Not known	None	Low
CA2/16 Canalside Farm	Horticulture - strawberries in Spanish polytunnels	10	Mainly farm shop, café and land let as narrow-boat marina	None	High
CA2/17* Land north of River Trent	Grassland	27	Not known	None	Low
CA2/18 Land north of Mill Lane	Pasture – let	6	None	None	Low
CA2/19 Hoo Mill Lane Farm	Suckler beef selling finished cattle	113	None	None	Medium
CA2/20 Ingestre Manor Farm	Arable, sheep and store cattle	526	Aspiration to develop a livery yard with a cross-country course	HLS and ELS across the farm	Medium
CA2/21 Land at Tixall Lane	Grassland used for horse grazing	3	None	None	Low
CA2/22 Land south of Lionlodge	Grassland used for horse grazing	3	None	None	Low
CA2/23 Tixall Manor Farm	Beef suckler herd and arable	117	None	None	Medium
CA2/24* Lionlodge Covert	Grassland and woodland	25	Not known	None	Low
CA2/25 Upper Hanyards Farm	Dairy and sheep	360	Two wind turbines and farm shoot	None	High

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
CA2/26 Park Farm, Stafford	Permanent grass cut for silage/haylage for sale and winter grazing of sheep	79 (including shared farmed land)	Three-day eventing course, space let for rail engineering firm, four residential barn conversions let, bed and breakfast, caravan site and land rented to Staffordshire County Showground for car parking and show jumping	None	Medium
CA2/27 Brick House Farm	Arable and sheep (with share farming partner)	168	Land let to Staffordshire County Showground for car parking	None	Medium
CA2/28[43] Land south of Hopton	Grassland (let)	80	Not known	None	Low
CA2/29* Lower Bridge Farm	Equestrian	13	Not known	None	Low
CA2/30* Wadden Farm	Grassland	24	Not known	None	Medium
CA2/31 Oaklands	Sheep	18	Boarding kennels, agricultural contracting (hedge cutting), trailer repair	None	Medium
CA2/32 New Buildings Farm[44]	Dairy	228	None	None	High
CA2/33 Kent's Barn Farm[45]	Beef cattle and sheep	32	Agricultural contracting (fencing)	None	Medium
CA2/34 Marston Farm	Arable	43	Agricultural contracting, property lets	ELS	Medium
CA2/35 Sunnyhill Farm	Arable	39	None	ELS	Medium
CA2/36 The Barn, Marston	Residential with equestrian	2.5	None	None	Low

[43] Two separate land owners, but occupied by the same lessee; also, sensitivity reduced as land affected is off-lying from the main holding where the dairy herd is located.
[44] This is also shown on OS mapping as Newbuildings Farm.
[45] This is also shown on OS mapping as Kent's Barn Farm.

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment scheme	Sensitivity to change
CA2/37 Park Farm, Marston	Dairy	118	Occasional agricultural contracting	None	High
CA2/38 Yarlet Hall Farm	Dairy and beef cattle	47	None	None	High
CA2/39 Grove Farm	Grassland (let)	2	Metalwork fabrication in farm buildings	None	Low
CA2/40 Holding No.33	Dairy and sheep	79	None	None	High
CA2/41 Hilltop Farm	Grassland (let)	5	None	0.5ha planted under Woodland Grant Scheme	Low
CA2/42 Yarlet Bank Farm	Grassland	3	None	None	Low
CA2/43 Long Enson Farm	Dairy and beef cattle (affected land not part of dairy grazing block)	48	None	None	Medium
CA2/44 Greenwood Farm	Dairy	162	None	None	High

* No Farm Impact Assessment interview conducted; data estimated.

Future baseline

Construction (2020)

4.3.36 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2020.

4.3.37 No committed developments have been identified in this study area that will materially alter the baseline conditions in 2020 for agriculture, forestry and soils.

Operation (2027)

4.3.38 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2027.

4.3.39 No committed developments have been identified in this study area that will materially alter the baseline conditions in 2027 for agriculture, forestry and soils.

4.4 Effects arising during construction

Avoidance and mitigation measures

4.4.1 During the development of the design, the following measures have been incorporated to avoid or mitigate adverse impacts on agriculture, forestry or soils:

- agricultural crossing incorporated into Colwich Bridleway 35 accommodation overbridge at Tithebarn Farm (CA2/7);
- agricultural crossing incorporated into Colwich Bridleway 58 accommodation underbridge at Tithebarn Farm (CA2/7);
- agricultural access provided for Tixall Manor Farm (CA2/23) via Ingestre underbridge;
- realignment of the Tixall Bridleway 0.1628 accommodation overbridge at Upper Hanyards Farm (CA2/25) to minimise the area of agricultural land required as a result of the Proposed Scheme;
- restricted headroom access to Park Farm, Stafford (CA2/26) via Trent Walk underbridge;
- agricultural crossing incorporated into Hopton and Coton Footpath 24 accommodation overbridge at Brick House Farm (CA2/27), and realigned access track from B5066 Sandon Road to provide secondary access to farmland;
- agricultural crossing incorporated into Hopton and Coton Bridleway 11 accommodation overbridge at New Buildings Farm (CA2/32); and
- agricultural crossing incorporated into Marston Bridleway 8 accommodation underbridge at Marston Farm (CA2/34).

4.4.2 The permanent severance of agricultural land for various holdings is also avoided by the ability of agricultural machinery and livestock to pass under the Great Haywood viaduct.

4.4.3 Other design refinements to reduce the impact of the construction of the Proposed Scheme on agriculture, forestry and soil resources have included:

- rationalisation of balancing ponds to seek to locate them in least sensitive agricultural locations;
- locally slackened or steepened slopes to improve agricultural land use;
- rationalisation of road realignments to reduce the area of agricultural land required;
- incorporation of agricultural tracks to gain access to severed land; and
- rationalisation and relocation of mitigation planting to reduce the area of agricultural land required and reduce impacts on holdings.

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

4.4.5 Compliance with the Code of Construction Practice (CoCP) will avoid or reduce environmental impacts during construction. Those measures that are particularly relevant to agriculture, forestry and soils are set out in the draft CoCP[46] and relate to:

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

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

4.4.7 Where agricultural uses are to be resumed on land disturbed during the construction of the Proposed Scheme, the design objective is to avoid any reduction in long term capability, which would downgrade the quality of the disturbed land, through the adoption of good practice techniques in handling, storing and reinstating soils on that

[46] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

land. Land with heavier textured soils, such as the Midelney, Clifton and Whimple 3 association soils, may also require particularly careful management, such as the timing of cultivation and livestock grazing, during the aftercare period to ensure this outcome.

Assessment of impacts and effects

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

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

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

Temporary effects during construction

Impacts on agricultural land

4.4.10 During the construction phase, the total area of agricultural land used within the Colwich to Yarlet area will be approximately 379ha as shown in Table 11. Of this total, it is anticipated that approximately 181ha will be restored and available for agricultural use following construction.

Table 11: Agricultural land required for the construction of the Proposed Scheme

Agricultural land quality	Area required (ha)	Percentage of agricultural land	Area to be restored (ha)
Grade 1	0	0	0
Grade 2	94.4	25	38.3
Subgrade 3a	245.6	65	125.8
BMV subtotal	**340.0**	**90**	**164.1**
Subgrade 3b	14.8	4	5.5
Grade 4	24.2	6	11.6
Grade 5	0	0	0

Agricultural land quality	Area required (ha)	Percentage of agricultural land	Area to be restored (ha)
Total agricultural land	379.0	100	181.2

4.4.11 The disturbance during construction to approximately 340ha of BMV land is assessed as an impact of high magnitude, comprising 90% of the agricultural land requirement. BMV land is assessed as a receptor of low sensitivity because of its relative abundance in this area. The effect of the Proposed Scheme on BMV land during the construction phase is therefore assessed as moderate adverse, which is significant.

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

Nature of the soil to be disturbed

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

4.4.14 Successful soil handling is dependent upon movements being undertaken under appropriate weather and ground conditions using the appropriate equipment. The principles of soil handling are well established and set out in advisory material such as Defra's Code of Practice for the Sustainable Use of Soils[47]. These principles will be followed throughout the construction period.

4.4.15 The clayey and seasonally waterlogged Midelney and Whimple 3 associations are least able to remain structurally stable if moved in wet conditions or by inappropriate equipment. They are susceptible to compaction and smearing, which could affect successful reinstatement. Implementation of the measures set out in the draft CoCP will ensure the magnitude of impact on soil will be low and the significance of the effect will be negligible and not significant.

4.4.16 The disturbance of peat soils has implications for carbon emissions and biodiversity. The Proposed Scheme seeks to reduce disturbance of any deep peat soils insofar as reasonably practicable. Where disturbance cannot be avoided, the peat soils will be handled with particular care to avoid compaction when wet and wind erosion when soils are dry. When reinstated, opportunities will be taken to use peat soils to create habitats, enhance biodiversity and build carbon reserves.

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

Impacts on holdings

4.4.17 Land may be required for the Proposed Scheme from holdings temporarily, during the construction period, or permanently. In most cases, the temporary and permanent land requirement will occur simultaneously at the start of the construction period and it is the combined effect of both that will have the most impact on the holding. During the construction period, some agricultural land will be restored and the impact on individual holdings will reduce.

4.4.18 The effects of the Proposed Scheme on individual agricultural and related interests during the construction period are summarised in Table 12. This table shows the total area of land required from a particular holding in absolute terms and as a percentage of the total area farmed. It also shows the area of land that could be returned to the holding following the construction period. The degree of impact is based on the proportion of the holding required rather than the absolute area of land.

4.4.19 The effects of severance during construction are judged on the ease and availability of access to severed land. With the implementation of measures set out in the draft CoCP, these will generally be the same during and post construction. The disruptive effects, principally of construction noise and dust, are assessed according to their effects on land uses and enterprises. Impacts on residential properties on farm holdings are assessed, as required, in Section 5, Air quality; Section 6, Community; and Section 13, Sound, noise and vibration. Full details of the nature and significance of effects are set out in Volume 5: Appendix AG-001-002.

4.4.20 Upper Moreton Farm (CA2/1), Moreton Farm (CA2/2) and Quintons Orchard Farm (CA1/25) all have land affected by the Proposed Scheme in the Fradley to Colton area (CA1) and the Colwich to Yarlet area. As the main farm buildings for the first two are within the Colwich to Yarlet area, the assessments of impacts and effects for those holdings are reported in this chapter. As the main farm buildings at Quintons Orchard Farm are located in the Fradley to Colton area, the assessment is reported in Volume 2: Community area 1, Fradley to Colton.

4.4.21 In the north of the study area, New House Farm (CA3/1) includes land affected by the Proposed Scheme in both the Colwich to Yarlet area and the Stone and Swynnerton area (CA3); the assessment of impacts on that holding are assessed in Volume 2: Community area 3, Stone and Swynnerton.

Table 12: Summary of effects on holdings during construction

Holding reference/ name/sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CA2/1 Upper Moreton Farm Medium sensitivity	3.1ha (13%) Medium	Negligible	Low	Moderate adverse due to the proportion of the farm required	0.2ha
CA2/2 Moreton Farm Medium sensitivity	21.6ha (20%) High	Low	Negligible	Major/moderate adverse due to the proportion of the farm required	18.8ha

Holding reference/ name/sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CA2/3 Woodruff Barn Low sensitivity	1.9ha (100%) High	Negligible	Negligible	Moderate adverse due to the proportion of the farm required	1.8ha
CA2/4 Land at Moreton Grange Low sensitivity	0.9ha (94%) High	Low	Low	Moderate adverse due to the proportion of the holding required	0ha
CA2/5 Bottom End Cottage Low sensitivity	2.0ha (98%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	0.3ha
CA2/6 Moreton House Farm Medium sensitivity	11.4ha (8%) Low	Low	Medium	Moderate adverse due to disruption during construction	5.4ha
CA2/7 Tithebarn Farm Medium sensitivity	48.0ha (30%) High	Low	High	Major/moderate adverse due to the proportion of the holding required and disruption during construction	24.3ha
CA2/8 Far Coley Farm Medium sensitivity	0.1ha (<1%) Negligible	Negligible	Negligible	Negligible	0ha
CA2/9 Farley Farm Medium sensitivity	10.6ha (19%) Medium	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	8.3ha
CA2/10 Land at Tolldish Lane Low sensitivity	1.1ha (56%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	0.4ha
CA2/11 Avondale Low sensitivity	3.4ha (100%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	0.7ha
CA2/12 The Green Barn Medium sensitivity	10.3ha (69%) High	Negligible	High	Major/moderate adverse due to the proportion of the holding required and disruption during construction	3.3ha
CA2/13 Tixall Lodge Estate	4.7ha (2%) Negligible	Negligible	Negligible	Negligible	2.8ha

Holding reference/ name/sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
Medium sensitivity					
CA2/14 Land west of A51 Lichfield Road, Lichfield Low sensitivity	2.4ha (100%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	2.4ha
CA2/15 Land south of Hoo Mill Lane Low sensitivity	1.8ha (44%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	1.2ha
CA2/16 Canalside Farm High sensitivity	2.5ha (25%) High	Low	Medium	Major adverse due to the proportion of the holding required	2.3ha
CA2/17 Land north of RiverTrent Low sensitivity	3.7ha (14%) Medium	Negligible	Negligible	Minor adverse	0ha
CA2/18 Land north of Mill Lane Low sensitivity	1.7ha (29%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	0.1ha
CA2/19 Hoo Mill Lane Farm Medium sensitivity	6.1ha (5%) Low	Medium	Low	Moderate adverse due to possible severance during construction	5.6ha
CA2/20 Ingestre Manor Farm Medium sensitivity	7.1ha (1%) Negligible	Negligible	Low	Minor adverse	3.3ha
CA2/21 Land at Tixall Lane Low sensitivity	0.3ha (7%) Low	Low	Negligible	Negligible	0.3ha
CA2/22 Land south of Lionlodge Low sensitivity	3.0ha (100%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	0.3ha
CA2/23 Tixall Manor Farm	23.8ha (20%) High	Low	Negligible	Major/moderate adverse due to the proportion of the holding required	7.6ha

Holding reference/ name/sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
Medium sensitivity					
CA2/24 Lionlodge Covert Low sensitivity	2.9ha (17%) Medium	Negligible	Negligible	Minor adverse	0.9ha
CA2/25 Upper Hanyards Farm High sensitivity	42.5ha (12%) Medium	Low	High	Major adverse due to disruption during construction	23.2ha
CA2/26 Park Farm, Stafford Medium sensitivity	5.3ha (7%) Low	Low / medium	High	Major/moderate adverse due to disruption during construction	0.9ha
CA2/27 Brick House Farm Medium sensitivity	35.3ha (21%) High	Low	Negligible	Major/moderate adverse due to the proportion of the farm required	21.2ha
CA2/28 Land south of Hopton Low sensitivity	9.2ha (12%) Medium	Medium	Low	Minor adverse	0.7ha
CA2/29 Lower Bridge Farm Low sensitivity	7.2ha (55%) High	Negligible	High	Moderate adverse due to the proportion of the holding required and disturbance during construction	0.4ha
CA2/30 Wadden Farm Medium sensitivity	2.1ha (9%) Low	Negligible	Negligible	Minor adverse	1.1ha
CA2/31 Oaklands Medium sensitivity	0.1ha (1%) Negligible	Negligible	Negligible	Negligible	0.1ha
CA2/32 New Buildings Farm High sensitivity	42.2ha (19%) Medium	Low	Medium	Major/moderate adverse due to the proportion of the farm required and disturbance during construction	21.3ha
CA2/33 Kent's Barn Farm Medium sensitivity	2.6ha (8%) Low	Negligible	Negligible	Minor adverse	1.1ha

Holding reference/ name/sensitivity	Total area required from holding	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CA2/34 Marston Farm Medium sensitivity	7.9ha (18%) Medium	Medium	Medium	Moderate adverse due to the proportion of the holding required, severance and disturbance during construction	3.5ha
CA2/35 Sunnyhill Farm Medium sensitivity	12.4ha (32%) High	Medium	Medium	Major/moderate adverse due to the proportion of the farm required	5ha
CA2/36 The Barn, Marston Low sensitivity	2.1ha (83%) High	Medium	Negligible	Moderate adverse due to the proportion of the holding required	0ha
CA2/37 Park Farm, Marston High sensitivity	12.3ha (11%) plus 31ha severed and not realistically accessible High	High	High	Major adverse due to the proportion of the farm required, severance and disruption	5.1ha
CA2/38 Yarlet Hall Farm High sensitivity	14.8ha (32%) High	Medium	Low	Major adverse due to the proportion of the holding required	4.4ha
CA2/39 Grove Farm Low sensitivity	0.7ha (35%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required	0.3ha
CA2/40 Holding No.33 High sensitivity	7.7ha (10%) Medium	Negligible	Negligible	Major/moderate adverse due to the proportion of the holding required	7.0ha
CA2/41 Hilltop Farm Low sensitivity	0.4ha (8%) Negligible	Negligible	Medium	Minor adverse	0.4ha
CA2/42 Yarlet Bank Farm Low sensitivity	0.5ha (17%) High	Negligible	High	Minor adverse	0.2ha
CA2/43 Long Enson Farm Medium sensitivity	9.6ha (20%) High	Medium	Negligible	Major/moderate adverse due to the proportion of the farm required	0.9ha
CA2/44 Greenwood Farm High sensitivity	4.4ha (3%) Negligible	Negligible	Negligible	Minor adverse	0.5ha

4.4.22 Overall, 44 holdings in the Colwich to Yarlet area will be affected during construction, of which 31 will experience moderate, major/moderate or major adverse effects, which are significant.

4.4.23 The most significant effects often arise on the large, commercial dairy farms that rely on the ready availability of access between the milking parlour and grazing land. In this study area the significantly affected dairy farms are:

- Upper Hanyards Farm (CA2/25);
- New Buildings Farm (CA2/32);
- Park Farm, Marston (CA2/37);
- Yarlet Hall Farm (CA2/38);
- Holding No.33 (CA2/40); and
- Long Enson Farm (CA2/43).

4.4.24 Other larger, commercial holdings significantly affected are Upper Moreton Farm (CA2/1), Moreton Farm (CA2/2), Moreton House Farm (CA2/6), Tithebarn Farm (CA2/7), Canalside Farm (CA2/16), Tixall Manor Farm (CA2/23), Brick House Farm (CA2/27), Marston Farm (CA2/34) and Sunnyhill Farm (CA2/35).

4.4.25 The other holdings that are significantly affected are either smaller farms that rely mainly on diversified income such as Farley Farm (CA2/9), Avondale (CA2/11), The Green Barn (CA2/12), Hoo Mill Lane Farm (CA2/19) or Park Farm, Stafford (CA2/26); or are small paddocks used for horse grazing such as Woodruff Barn (CA2/3), Bottom End Cottage (CA2/5), Land south of Lionlodge (CA2/22) or The Barn, Marston (CA2/36).

Permanent effects of construction

Impacts on agricultural land

4.4.26 Following construction and restoration, the area of agricultural land that will remain permanently required will be approximately 198ha, as shown in Table 13.

Table 13: Agricultural land required permanently

Agricultural land quality	Total area required (ha)	Percentage of agricultural land
Grade 1	0	0
Grade 2	56.1	28
Subgrade 3a	119.8	61
BMV subtotal	**175.9**	**89**
Subgrade 3b	9.2	5
Grade 4	12.6	6
Grade 5	0	0
Total agricultural land	**197.7**	**100**

4.4.27 Of this total requirement, approximately 54ha (27%) will comprise newly planted woodlands for visual screening and habitat creation to mitigate environmental effects arising from the Proposed Scheme, as set out in Section 8, Ecology and biodiversity and Section 11, Landscape and visual.

4.4.28 An area of 0.1ha of agricultural land shown on CT-06-212 (Volume 2: CA2 Map Book) will be engineered to provide replacement floodplain storage but, as this land is not BMV land, the downgrading effects on agricultural land quality will be negligible. This assessment assumes that this land will return to agricultural use.

4.4.29 The permanent requirement for approximately 176ha of BMV land within the Colwich to Yarlet area is assessed as an impact of high magnitude, comprising 89% of the overall agricultural land requirement. BMV land is assessed as a receptor of low sensitivity because of its relative abundance in this area. The permanent effect on BMV land is therefore assessed as moderate adverse, which is significant.

Impacts on forestry land

4.4.30 The total area of woodland required as a result of the Proposed Scheme in the Colwich to Yarlet area will be approximately 8.5ha, as set out in Section 8, Ecology and biodiversity, out of a total permanent land requirement (including non-agricultural land) of approximately 240ha (4%). This requirement is mainly from woodlands around Ingestre, particularly from Lionlodge Covert and The Grove. Although these woods are managed, there is no indication that they are managed as commercial forestry, and therefore the impacts on these resources are reported in Section 8, Ecology and biodiversity.

4.4.31 The permanent requirement for woodland is assessed as an impact of low magnitude in land use terms and, as the area of woodland is slightly below the average national woodland cover (10%), the effect on forestry land is not considered to be significant in quantitative terms and in terms of the agriculture, forestry and soils assessment. The qualitative assessment of loss of native woodland is addressed in Section 8, Ecology and biodiversity.

Impacts on holdings

4.4.32 The permanent effects from the construction of the Proposed Scheme on individual agricultural and related interests are summarised in Table 14. The land required column refers to the area of land required to operate the Proposed Scheme in absolute terms and as a percentage of the overall area farmed. The scale of effect is based on the likely proportion of land required from the holding. The effects of severance are judged on the ease and availability of access to severed land once construction is completed. The impact on farm infrastructure refers mainly to the loss of or damage to farm capital, such as property, buildings and structures, and the consequential effects on land uses and enterprises. Full details of the nature and scale of effects are set out in Volume 5: Appendix AG-001-002.

Table 14: Summary of permanent effects on holdings from construction

Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
CA2/1 Upper Moreton Farm Medium sensitivity	2.9ha (12%) Medium	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA2/2 Moreton Farm Medium sensitivity	2.8ha (3%) Negligible	Low	Negligible	Minor adverse
CA2/3 Woodruff Barn Low sensitivity	0.1ha (5%) Low	Negligible	Negligible	Negligible
CA2/4 Land at Moreton Grange Low sensitivity	0.9ha (94%) High	Low	Negligible	Moderate adverse due to the proportion of the holding required
CA2/5 Bottom End Cottage Low sensitivity	1.7ha (86%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA2/6 Moreton House Farm Medium sensitivity	6.0ha (4%) Negligible	Low	Medium	Moderate adverse due to the demolition of a wind turbine
CA2/7 Tithebarn Farm Medium sensitivity	23.7ha (15%) Medium	Low	High	Major/moderate adverse due to the demolition of the farmstead
CA2/8 Far Coley Farm Medium sensitivity	<0.1ha (<1%) Negligible	Negligible	Negligible	Negligible
CA2/9 Farley Farm Medium sensitivity	2.3ha (4%) Negligible	Negligible	Negligible	Negligible
CA2/10 Land at Tolldish Lane Low sensitivity	0.7ha (33%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA2/11 Avondale Low sensitivity	2.7ha (79%) High	Negligible	High	Moderate adverse due to the proportion of the holding required and property demolition
CA2/12 The Green Barn Medium sensitivity	7.0ha (47%) High	Negligible	High	Major/moderate adverse due to the proportion of the holding required and demolition of barns
CA2/13	1.9ha (<1%)	Negligible	Negligible	Negligible

Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
Tixall Lodge Estate Medium sensitivity	Negligible			
CA2/14 Land west of A51 Lichfield Road, Lichfield Low sensitivity	<0.1ha (<1%) Negligible	Negligible	Negligible	Negligible
CA2/15 Land south of Hoo Mill Lane Low sensitivity	0.6ha (16%) Medium	Negligible	Negligible	Minor adverse
CA2/16 Canalside Farm High sensitivity	0.2ha (2%) Negligible	Negligible	Negligible	Minor adverse
CA2/17 Land north of RiverTrent Low sensitivity	3.7ha (14%) Medium	Negligible	Negligible	Minor adverse
CA2/18 Land north of Mill Lane Low sensitivity	1.6ha (27%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA2/19 Hoo Mill Lane Farm Medium sensitivity	0.5ha (<1%) Negligible	Negligible	Negligible	Negligible
CA2/20 Ingestre Manor Farm Medium sensitivity	3.8ha (<1%) Negligible	Negligible	Negligible	Negligible
CA2/21 Land at Tixall Lane Low sensitivity	<0.1ha (<1%) Negligible	Negligible	Negligible	Negligible
CA2/22 Land south of Lionlodge Low sensitivity	2.7ha (90%) High	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CA2/23 Tixall Manor Farm Medium sensitivity	16.2ha (14%) Medium	Low	Negligible	Moderate adverse due to the proportion of the holding required
CA2/24 Lionlodge Covert Low sensitivity	2.0ha (12%) Medium	Negligible	Negligible	Minor adverse

Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
CA2/25 Upper Hanyards Farm High sensitivity	19.3ha (5%) Low	Low	High	Major adverse due to the demolition of the farmstead
CA2/26 Park Farm, Stafford Medium sensitivity	4.4ha (6%) Low	Low / Medium	High	Major/moderate adverse due to property demolition
CA2/27 Brick House Farm Medium sensitivity	14.1ha (8%) Low	Low	Negligible	Minor adverse
CA2/28 Land south of Hopton Low sensitivity	8.5ha (11%) Medium	Medium	Negligible	Minor adverse
CA2/29 Lower Bridge Farm Low sensitivity	6.8ha (52%) High	Negligible	High	Moderate adverse due to the proportion of the holding required and property demolition
CA2/30 Wadden Farm Medium sensitivity	1.0ha (4%) Negligible	Negligible	Negligible	Negligible
CA2/31 Oaklands Medium sensitivity	<0.1ha (<1%) Negligible	Negligible	Negligible	Negligible
CA2/32 New Buildings Farm High sensitivity	20.8ha (9%) Low	Low	Medium	Major/moderate adverse due to the removal of internal farm accesses
CA2/33 Kent's Barn Farm Medium sensitivity	1.5ha (5%) Low	Negligible	Negligible	Minor adverse
CA2/34 Marston Farm Medium sensitivity	4.4ha (10%) Low	Negligible	Negligible	Minor adverse
CA2/35 Sunnyhill Farm Medium sensitivity	7.4ha (19%) Medium	Medium	High	Major/moderate adverse due to demolition of farm buildings
CA2/36 The Barn, Marston Low sensitivity	2.1ha (83%) High	Medium	Negligible	Moderate adverse due to the proportion of the holding required
CA2/37 Park Farm, Marston	7.2ha (6%) plus 31ha severed and not	High	High	Major adverse due to the proportion of the holding required, severance and

Holding reference/name/sensitivity	Land required from holding	Severance	Infrastructure	Scale of effect
High sensitivity	realistically accessible High			demolition of silage clamp and slurry lagoon
CA2/38 Yarlet Hall Farm High sensitivity	10.4ha (22%) High	Low	Low	Major adverse due to the proportion of the holding required
CA2/39 Grove Farm Low sensitivity	0.4ha (19%) Medium	Negligible	Negligible	Minor adverse
CA2/40 Holding No.33 High sensitivity	0.7ha (1%) Negligible	Negligible	Negligible	Minor adverse
CA2/41 Hilltop Farm Low sensitivity	<0.1ha (<1%) Negligible	Negligible	Negligible	Negligible
CA2/42 Yarlet Bank Farm Low sensitivity	0.3ha (10%) Medium	Negligible	Negligible	Minor adverse
CA2/43 Long Enson Farm Medium sensitivity	8.7ha (18%) Medium	Medium	Negligible	Moderate adverse due to the proportion of the holding required and severance
CA2/44 Greenwood Farm High sensitivity	3.9ha (2%) Negligible	Negligible	Negligible	Minor adverse

4.4.33 Overall, the construction of the Proposed Scheme will affect 44 holdings in the Colwich to Yarlet area, with 20 holdings experiencing moderate, major/moderate or major adverse permanent effects, which are significant.

4.4.34 Three farms will incur major adverse permanent effects from construction. All are dairy farms and of high sensitivity. Upper Hanyards Farm (CA2/25) will incur high impacts on farm infrastructure with the demolition of the farm dwelling and livestock accommodation buildings. Park Farm, Marston (CA2/37) will incur high severance impacts (as ready access for dairy cows to the severed land cannot be provided) and the demolition of farm infrastructure. Yarlet Hall Farm (CA2/38) will incur high impacts due to the area of land required.

4.4.35 Other holdings that will also incur demolitions include Tithebarn Farm (CA2/7), Avondale (CA2/11), The Green Barn (CA2/12), Park Farm, Stafford (CA2/26)[48], Lower Bridge Farm (CA2/29) and Sunnyhill Farm (CA2/35). Other larger, commercial

[48] Chase View residential property and outbuildings fall within the holding of Park Farm, Stafford. These will be demolished as a result of the Proposed Scheme.

agricultural holdings significantly affected by the permanent works include Upper Moreton Farm (CA2/1), Tixall Manor Farm (CA2/23), New Buildings Farm (CA2/32) and Long Enson Farm (CA2/43).

4.4.36 The remaining significant effects arise mainly from high land requirements from small holdings.

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

Other mitigation measures

4.4.38 Soils and their associated seed banks from the ancient woodlands at Lionlodge Covert, The Grove, Town Field Plantation and Flushing Covert will be stored separately and utilised in species translocation, as discussed in Section 8, Ecology and biodiversity.

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

4.4.40 A farm pack is being provided to all farmers and landowners that sets out baseline conditions on the farm and the assurances and obligations that HS2 Ltd will accept upon entering the land. This will include advice and appropriate assistance where there is a need for the landowner to relocate or re-provide agricultural buildings displaced by the Proposed Scheme.

Summary of likely residual significant effects

4.4.41 During construction, the total area of agricultural land required is approximately 379ha, of which approximately 340ha is BMV land. This is assessed as a temporary moderate adverse residual effect, which is significant.

4.4.42 Forty-four holdings will be affected during the construction period, of which 31 will experience temporary major, major/moderate or moderate adverse residual effects, which are significant.

4.4.43 Once the construction process is complete and land required temporarily has been restored, the residual permanent requirement for agricultural land will be 198ha of which 176ha is BMV land. This is assessed as a permanent moderate adverse residual effect, which is significant.

4.4.44 Twenty holdings have been identified that will experience major, major/moderate or moderate permanent effects following construction, which is significant. Of these ten will be likely to remain as agricultural or rural businesses and the use of compensation payments to purchase replacement land or farm buildings could reduce the effects. Eight are mainly smaller holdings where the proportion of the holding required is large but the absolute area required is modest. The residual land associated with these holdings will remain in agricultural use.

4.4.45 Three commercial farms are likely to cease as a result of the construction of the Proposed Scheme: The Green Barn (CA2/12); Sunnyhill Farm (CA2/35); and Park Farm, Marston (CA2/37).

Cumulative effects

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

4.5 Effects arising from operation

Avoidance and mitigation measures

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

Assessment of impacts and effects

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

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

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

- Moreton House Farm (CA2/6);
- Park Farm, Stafford (CA2/26); and
- Park Farm, Marston (CA2/37).

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

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

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

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

Other mitigation measures

4.5.7 No other mitigation measures have been identified.

Summary of likely residual significant effects

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

Cumulative effects

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

Monitoring

4.5.10 On the basis of there being no significant residual operational effects, there are no area-specific requirements for monitoring agriculture, forestry and soil effects during the operation of the Proposed Scheme in the Colwich to Yarlet area.

5 Air quality

5.1 Introduction

5.1.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction and operation of the Proposed Scheme within the Colwich to Yarlet area. Oxides of nitrogen (NOx) including nitrogen dioxide (NO_2), fine particulate matter (PM10, PM2.5)[49] and dust have been considered in the assessment. Emissions of all or some of these air pollutants are likely to arise from construction activities, demolition, site preparation works and the use of site haul routes. Emissions will also arise from road traffic during construction and operation of the Proposed Scheme.

5.1.2 Engagement with Stafford Borough Council (SBC) and Staffordshire County Council (SCC) has been undertaken. The purpose of this engagement has been to obtain relevant baseline information, which includes monitoring data in this area. Detailed reports on the air quality data and assessments for this area, are contained within Volume 5: Appendix AQ-001-002.

5.1.3 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book. Air quality mapping is presented in the Volume 5: Air quality Map Book, Map AQ-01-102.

5.1.4 In addition, the traffic data used for the air quality assessment is set out in Background Information and Data (BID)[50], (see BID-AQ-002-000: Traffic data used for the air quality assessment).

5.2 Scope, assumptions and limitations

5.2.1 The scope, assumptions and limitations for the air quality assessment are set out in full in Volume 1 (Section 8), the Scope and Methodology Report (SMR)[51], the SMR Addendum[52] and Volume 5: Appendix AQ-001-002.

5.2.2 The study areas for the air quality assessment have been determined on the basis of where impacts on local air quality may occur[53]:

- from construction and/or mineral extraction activities (borrow pits);

[49] PM2.5 and PM10 describe two size fractions of airborne particles that can be inhaled and therefore are of concern for human health. The designations refer to particles of size less than 2.5 and 10 microns in diameter.
[50] HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at: www.gov.uk/hs2
[51] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[52] Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.
[53] The assessment of construction dust emissions has been undertaken where sensitive receptors are located up to a distance of 350m from dust generating activities. The assessment of mineral dust emissions has been undertaken for sensitive receptors located within a distance of 250m from a borrow pit site. The assessment of traffic emissions has been undertaken where sensitive receptors are located up to a distance of 200m from roads screened in for further assessment.

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

5.2.3 The assessment has incorporated HS2 Ltd's policies on vehicle emissions[54]. These include the use of Euro VI heavy goods vehicles (HGVs), Euro 4 petrol and Euro 6 diesel cars and light goods vehicles (LGVs) during construction of the Proposed Scheme.

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

5.3 Environmental baseline

Existing baseline

Background air quality

5.3.1 The main sources of air pollution in the Colwich to Yarlet area are emissions from road vehicles and agricultural activities. The main roads within the area are: the M6; the A34 Stone Road; the A518 Weston Road; the A51 Lichfield Road; and the A513 Beaconside.

5.3.2 There are three industrial installations (regulated by the Environment Agency) with permits for emissions to air within the area, namely: Bostik Ltd - Common Road Emulsion Polymer Plant; JBMI Group Ltd - Kingsilver Refinery, Hixon Industrial Estate; and Grindley Biogas Limited, Grindley House Farm. Details of their location are presented in Volume 5: Appendix AQ-001-002.The contribution of all industrial processes and other emission sources to local air quality is included within the background concentrations.

5.3.3 Estimates of background air quality have been obtained from the Department for Environment Food & Rural Affairs (Defra[55]) for the baseline year of 2016. The data are estimated for 1km grid squares for NOx, NO2, PM10 and PM2.5. Background concentrations are within the air quality standards as defined in the SMR and the SMR Addendum, for all pollutants within the Colwich to Yarlet area.

Local monitoring data

5.3.4 There are currently four diffusion tube sites located within the Colwich to Yarlet area for monitoring NO2 concentrations. These are located at junction 14 of the M6 and

[54] HS2 Phase 2a Information Paper E14: Air Quality
[55] Department for Environment, Food and Rural Affairs; (2013); Defra Background Pollutant Concentration Maps; http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013;

along the A34 Stone Road. Measured concentrations at these sites in 2015[56] were within the air quality standard. Details of their location and data measurements are presented in Volume 5: Map AQ-01-102 and Appendix AQ-001-002.

Air quality management areas

5.3.5 There are no air quality management areas within the Colwich to Yarlet area.

Receptors

5.3.6 Several locations have been identified in the area as sensitive receptors, which are considered to be susceptible to changes in air quality due to their proximity to dust-generating activities or traffic routes during construction or operation of the Proposed Scheme. Details of their location are presented in Volume 5: Map AQ-01-102 and Appendix AQ-001-002.

5.3.7 Most of the receptors located close to the route of the Proposed Scheme are residential. Other receptors include the Mayfield Children's Home (at Moreton House), Little Ingestre House care home and Yarlet School.

5.3.8 There are three statutory designated ecological sites identified in the area, namely Pasturefields Salt Marsh Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI), which is located adjacent to the A51 Lichfield Road, between Hixon and Ingestre; Tillington Marshes SSSI, which is located adjacent to the M6, south of junction 14 north-west of Stafford; and Chartley Moss SSSI, a component of the West Midlands Mosses SAC and Midland Meres and Mosses Phase 1 Ramsar site, located to the north-east of Great Haywood. Other non-statutory sensitive ecological sites, identified close to the Proposed Scheme, include the Lionlodge Covert Local Wildlife Site and the ancient woodlands of Tithebarn Covert, Ingestre Wood, Flushing Covert, Town Field Plantation and The Grove. Further details of the ecological receptors are set out in Section 8, Ecology and biodiversity. Habitats Regulations Assessments (HRA) have been undertaken for the Pasturefields Salt Marsh SAC and SSSI and the Chartley Moss SSSI, including an assessment of air quality impacts[57, 58].

Future baseline

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

[56] At the time of assessment, measurements for 2015 were the latest published annual monitoring data.
[57] Volume 5: Appendix EC-017-003, Habitats Regulations Assessment screening report for Pasturefields Salt Marsh Special Area of Conservation; and Volume 5: Appendix EC-017-004, Habitats Regulations Assessment screening report for Pasturefields Salt Marsh Special Area of Conservation addendum.
[58] Volume 5: Appendix EC-017-005, Habitats Regulations Assessment screening report for the Chartley Moss Site of Special Scientific Interest element of the Midland Meres and Mosses Phase 1 Ramsar site and the West Midland Mosses Special Area of Conservation.

Construction (2020)

5.3.10 Future background pollutant concentrations have been sourced from the Defra background maps for the first year of construction in 2020[59], which predict NO2, PM10 and PM2.5 levels in 2020 to be lower than in the 2016 baseline and within the relevant air quality standards.

5.3.11 Committed developments that have been included as future receptors in the assessment of air quality impacts during construction of the Proposed Scheme are identified in Volume 5: AQ-001-002. No additional committed developments have been identified in this area that will materially alter the baseline conditions in 2020 for air quality.

Operation (2027)

5.3.12 Future background pollutant concentrations have been sourced from the Defra background maps for 2027[60], which predict NO2, PM10 and PM2.5 levels in 2027 to be lower than in the 2016 baseline and within the relevant air quality standards.

5.3.13 Committed developments that have been included as future receptors in the assessment of air quality impacts during operation of the Proposed Scheme are identified in Volume 5: AQ-001-002. No additional committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for air quality.

5.4 Effects arising during construction

Avoidance and mitigation measures

5.4.1 Emissions to the atmosphere will be controlled and managed during construction through the route-wide implementation of the Code of Construction Practice (CoCP). The draft CoCP[61] includes a range of mitigation measures that are accepted by the Institute of Air Quality Management (IAQM) as being suitable to reduce impacts to as low a level as is reasonably practicable. These measures are generally sufficient to avoid any significant effects from dust during construction.

5.4.2 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP will be implemented. These include:

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

[59] Department for Environment, Food and Rural Affairs (Defra) (2013) Defra Background Pollutant Concentration Maps 2020; http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013;
[60] Department for Environment, Food and Rural Affairs (Defra) (2013) Defra Background Pollutant Concentration Maps 2027; http://uk-air.defra.gov.uk/data/laqm-background-maps?year=2013;
[61] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

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

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

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

Assessment of impacts and effects

Temporary effects

5.4.5 Impacts from construction of the Proposed Scheme could arise from dust-generating activities and emissions from construction traffic. As such, the assessment of construction impacts has been undertaken for dust and exposure to NO2, PM10 and PM2.5 concentrations.

Construction dust effects

5.4.6 Construction activities, such as demolition of existing buildings, earthworks, construction of new structures and trackout[62], have been assessed for their risk of having an effect on dust soiling, human health[63] and ecological sites. There are residential and ecological receptors located within 350m of these activities in the Colwich to Yarlet area.

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

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

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

5.4.9 With the application of the mitigation measures contained in the draft CoCP, no significant effects are anticipated from these risks associated with the dust generating activities. The basis for this conclusion can be found in Volume 5: Appendix AQ-001-002, where the scale of dust emissions and the sensitivity of the area and receptors are fully described.

Construction traffic effects

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

5.4.11 The assessment of construction traffic emissions has been undertaken for a 'without the Proposed Scheme' scenario and a 'with the Proposed Scheme' scenario. The traffic data for each scenario includes the additional traffic from future committed developments.

5.4.12 Construction traffic data in the study area has been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in the construction period. These were primarily the main roads within the Colwich to Yarlet area, including the M6, the A34 Stone Road, the A518 Weston Road, the A51 Lichfield Road, the A513 Beaconside, Tixall Road and Mill Lane.

5.4.13 Significant effects are predicted at six residential receptors for NO_2 concentrations in the Colwich to Yarlet area. These receptors are located close to the M6, to the south-west of Stafford (along Devon Way, Southfields Road, Burton Bank Lane and Barn Bank Lane). NO_2 concentrations in this area are predicted to exceed the air quality standard even without the Proposed Scheme. No significant effects are predicted in relation to annual mean PM_{10} and $PM_{2.5}$ concentrations.

5.4.14 No significant effects are predicted at any of the ecological receptors.

Permanent effects

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

Other mitigation measures

5.4.16 Measures to monitor, manage and reduce significant air quality effects are set out in Section 7 of the draft CoCP. No further mitigation measures in relation to air quality during construction of the Proposed Scheme in the Colwich to Yarlet area have been identified.

Summary of likely residual significant effects

5.4.17 There will be a residual significant effect at six residential receptors close to the M6 in Stafford in relation to exceedances of NO_2 concentrations. However, NO_2 concentrations in this area are predicted to exceed the air quality standard even without the Proposed Scheme. No residual significant effects are anticipated at other locations in the Colwich to Yarlet area.

Cumulative effects

5.4.18 The data used for the air quality assessment takes account of predicted changes in traffic as a result of committed developments in the area. It is assumed that dust emissions from construction of other developments in the area will be controlled by appropriate measures as set out within their respective environmental management controls and therefore no cumulative effects for air quality are anticipated.

5.5 Effects arising from operation

Avoidance and mitigation measures

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

Assessment of impacts and effects

5.5.2 Impacts from the operation of the Proposed Scheme could arise from vehicle emissions and relate to changes in the volume, composition and distribution of road traffic and changes in road alignment. There will be no direct atmospheric emissions from the operation of trains that will cause an impact on air quality and therefore no assessment is required. Indirect emissions from sources such as rail and brake wear have been assumed to be negligible.

5.5.3 The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2027: a 'without the Proposed Scheme' scenario and a 'with the Proposed Scheme' scenario. The traffic data for each scenario includes the additional traffic from future committed developments.

5.5.4 Traffic data for the Colwich to Yarlet area has been screened to identify roads that require further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2027. These were the proposed re-aligned or diverted roads within the Colwich to Yarlet area, including Tolldish Lane, Hoo Mill Lane, the A518 Weston Road, the B5066 Sandon Road, Hopton Lane and Marston Lane.

5.5.5 No significant effects are predicted at any sensitive receptor in the operation year. Concentrations of NO_2, PM_{10} and $PM_{2.5}$ are predicted to be within the relevant air quality standards both with and without the Proposed Scheme.

5.5.6 No significant effects are anticipated at any of the ecological receptors in the area.

Other mitigation measures

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

Summary of likely residual significant effects

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

Cumulative effects

5.5.9 The data used for the air quality assessment takes account of predicted changes in traffic as a result of committed developments in the area, and therefore, their impacts have been included within the assessment.

Monitoring

5.5.10 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

5.5.11 On the basis of there being no significant residual operational effects, there are no area specific requirements for monitoring air quality effects during the operation of the Proposed Scheme in the Colwich to Yarlet area.

6 Community

6.1 Introduction

6.1.1 This section of the report describes the impacts and likely significant effects on local communities resulting from the construction and operation of the Proposed Scheme within the Colwich to Yarlet area.

6.1.2 The assessment draws on information gathered from engagement with the users and operators of community facilities including Upper Moreton Farm, Mayfield Children's Home and Rugeley School, Ingestre Park Golf Club, Ingestre Hall Residential Arts Centre, The Orangery at Ingestre, Staffordshire County Showground and Yarlet School. The purpose of this engagement has been to understand how the facilities are used and to obtain relevant baseline information to inform the design development and assessment of the Proposed Scheme.

6.1.3 Further details of the community assessments undertaken within the Colwich to Yarlet area are contained in Volume 5: Appendix CM-001-002.

6.1.4 Community assessment maps are provided in the Map Series CM-01 in Volume 5: Community Map Book. Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

6.2 Scope, assumptions and limitations

6.2.1 The assessment scope, key assumptions and limitations for the community assessment are set out in Volume 1 (Section 8) and the Scope and Methodology Report (SMR)[64] and SMR addendum[65].

6.2.2 The study area includes the areas of land required both temporarily and permanently for the Proposed Scheme. It also includes a wider corridor within which receptors or resources could be affected by a combination of significant residual effects drawing from the findings of other technical disciplines: noise, vibration, air quality, traffic (in relation to heavy goods vehicles (HGVs[66]) and visual intrusion. In addition, the study area has regard to the proposed routes of construction traffic and takes account of catchment areas for community facilities that could be affected where intersected by the Proposed Scheme. Overall, the study area is taken as the area of land that encompasses the likely significant effects of the Proposed Scheme.

6.2.3 Worker accommodation will be located at the Trent South embankment main compound. Construction worker impacts on community resources are considered at a route-wide level in Volume 3, Route-wide effects.

[64] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[65] Volume 5: Appendix CT-001 -002, Environmental Impact Assessment Scope and Methodology Report Addendum.
[66] HGV effects are increases in HGV construction traffic flows identified as significant by the Traffic and Transport topic. They contribute to in-combination effects on sensitive community resources which are located adjacent to a designated construction traffic route which experiences a significant increase in HGV traffic flows or a site haul route which experiences a significant number of HGV movements.

6.3 Environmental baseline

Existing baseline

6.3.1 The Colwich to Yarlet area covers approximately 15.2km of the Proposed Scheme in Staffordshire. The route of the Proposed Scheme will extend from west of Moreton in the south and travel north towards Hopton and on to Yarlet. The main concentrations of community facilities are in the larger settlements of Little Haywood, Great Haywood and Stafford. Ingestre, Tixall, Hopton, Marston and Yarlet are smaller villages and hamlets that are located close to the Proposed Scheme, and provide a smaller number of local services. Outside of the main settlements the area is characterised by small clusters of dwellings and individual dwellings within rural areas.

Settlements

6.3.2 Moreton is a small hamlet made up of approximately 13 residential properties, located approximately 1.9km north-east of Little Haywood. Access to the properties is restricted, and can only easily be gained via Bishton Lane. Further south along Bishton Lane there are a small number of additional isolated rural dwellings, located north of the West Coast Main Line (WCML).

6.3.3 North-east of Great Haywood, east of the A51 Lichfield Road, there are approximately 13 residential properties off Tolldish Lane and the A51 Lichfield Road.

6.3.4 Hoo Mill Basin is located off the Trent and Mersey Canal, north of Great Haywood. It provides temporary and permanent residential mooring points for canal boats. Hoo Mill Basin includes workshop space available to those who moor at the basin.

6.3.5 North of Great Haywood there are approximately six residential properties located on Hoo Mill Lane. Hoo Mill Lane is divided in two by the River Trent and does not allow for road or pedestrian crossing of the river.

6.3.6 The villages of Ingestre and Little Ingestre are approximately 2.3km and 1.5km north-west of Great Haywood respectively, and include approximately 76 residential properties in total. The villages share a single route of entry, via Ingestre Park Road. Also located in the villages are:

- St. Mary's Church, which holds services twice a month and has a regular congregation of approximately 40 people;
- The Stables riding school and bed and breakfast;
- The Orangery, which hosts community events;
- Ingestre Hall Residential Arts Centre, which is owned and managed by Sandwell Metropolitan Borough Council to provide residential arts based programmes for school and community groups;
- Ingestre Park Golf Club; and
- Little Ingestre House residential care home for the disabled.

6.3.7 Park Farm, Stafford is a small hamlet made up of seven residential properties, within the original farmhouse and converted outbuildings. They are accessible via Trent Walk

off the A518 Weston Road, located adjacent to the Staffordshire County Showground, approximately 1km north of the edge of Stafford.

6.3.8 Hopton is a village made up of approximately 160 residential properties, including residential properties located within the secure Ministry of Defence (MoD) Stafford Barracks, located to the south of the village. Community facilities within the village include St. Peter's Church, playing fields and a village hall.

6.3.9 Marston and Yarlet are small adjoining hamlets made up of approximately 56 residential properties in total. St. Leonard's Church is located within Marston.

Community facilities

6.3.10 Upper Moreton Farm is a Community Interest Company (CIC) that provides care services alongside being a working farm and is part of the Care Farming UK initiative. It is located approximately 2km north-east of Little Haywood. It provides educational visits for local schools, and rural therapy and care farming for people with mental health problems, multiple learning difficulties, emotional difficulties, and people who have experienced abuse or neglect. The vast majority of activities take place outside. Activities are also often undertaken at the nearby Lount Farm Local Wildlife Site (LWS).

6.3.11 Mayfield Children's Home is located in Moreton, and occupies the Grade II listed Moreton House. It is a specialist residential home for students at Rugeley School located in the Fradley to Colton area (CA1). The home has facilities for up to 23 children aged between five and 19 years old, with 40-50 staff. All of the children are severely autistic, with many also having special behavioural, learning or communication needs.

6.3.12 Yarlet School is located to the east of the A34 Stone Road, and provides independent education for children aged between two and 13 years old. The school grounds include a chapel, and overnight accommodation for part time boarding.

Recreational facilities

6.3.13 Great Haywood Marina is located off the Trent and Mersey Canal, north-west of Great Haywood. It provides temporary residential mooring points for canal boats and includes a convenience store, a café and a farm shop, which are located near to the entrance to the marina.

6.3.14 Ingestre Park Golf Club is located in the village of Ingestre. It is a private members' club with approximately 650 members. The course has 18 holes and is currently a 70/72-par course (men/women). In addition to the course, there is a club house that includes a bar, restaurant and a pro-shop. The club house facilities are used for a variety of social and recreational events and can cater for up to 200 people.

6.3.15 Staffordshire County Showground is a multi-purpose venue, comprising exhibition halls, conference suites, a 600 seat grandstand and caravan and camping facilities for use on show days. It is located to the north of Stafford, off the A518 Weston Road. It hosts a number of events each year including the Staffordshire County Show. A bridge club and a Young Farmers group meet at the Showground on a weekly basis.

Open space and public rights of way

6.3.16 The Sabrina Way is a long distance footpath and bridleway that extends north to south for approximately 330km (including Colwich Footpath 22, 23 and 35). It runs from the Claude Duval Bridleroute at Great Barrington in Gloucestershire to Hartington in the Derbyshire Peak District. The path forms part of the National Bridle Route Network and runs through five counties. It links bridleways between the Pennines and the Cotswolds and connects with a number of trails including Staffordshire Way and Two Saints Way and The Ridgeway.

6.3.17 The Trent and Mersey Canal Walk (including Colwich Footpath 63) is a long distance promoted PRoW of approximately 155km, which extends through Derbyshire, Staffordshire and Cheshire, along the Trent and Mersey Canal.

6.3.18 Two Saints Way (including Hopton and Coton Footpath 1 and 6, part of Kings Drive and part of Wilmorehill Lane) is a recreated pilgrimage route of approximately 148km, which spans between Chester in Cheshire and Lichfield in Staffordshire. The route partly follows the Heart of England Way. It passes the village of Hopton and crosses the Cannock Chase Area of Outstanding Natural Beauty (AONB).

6.3.19 Stones Circle Challenge (including Hopton and Coton Footpaths 11, 12, 14 and 16; Marston Footpath 1 and 9; and part of Marston Lane) is a 53km circular route around Stone, which starts at Yarnfield and passes through the villages of Swynnerton, Beech, Tittensor, Barlaston, Moddershall, Fulford, Milwich, Hartley Green, Salt, Hopton, Whitgreave and Norton Bridge.

Future baseline

Construction (2020)

6.3.20 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2020. The committed developments that have been identified in this area that will materially alter the baseline conditions in 2020 for community resources are set out in Table 15.

Table 15: Committed developments relevant to community

Map book Reference[67]	Planning reference	Description
CA2/56	13/18299/FUL	Additional residential property within existing agricultural buildings at Grove Farm in Yarlet
CA2/241	Allocation Policy Stafford North 2	Allocation for two housing sites for around 3,100 dwellings in total.

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

[67] Volume 5 Planning Data/Committed Development Map Book: Maps CT-13-105b to CT-13-109a-R1.

Operation (2027)

6.3.22 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2027.

6.3.23 No additional committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for community resources.

6.4 Effects arising during construction

Avoidance and mitigation measures

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

- a crossing of the route of the Proposed Scheme (Colwich Bridleway 23 accommodation green overbridge) has been added to maintain access to Bishton Lane;
- a temporary diversion of the A34 Stone Road will help to maintain access to residential properties off the A34 Stone Road and Yarlet School to avoid impacts during construction;
- the construction areas in the following locations have been designed to reduce the loss of residential properties and reduce impacts on existing residential properties:
  - the area of land required for construction around Trent South embankment and works to Tolldish Lane, the construction area around Hoo Mill Lane, for the Great Haywood viaduct, and the extent of the Trent South embankment main compound; and
  - the area of land required for construction around Hopton embankment;
- planting and landscape earthworks at the Trent South embankment to limit visual impacts at residential properties on Tolldish Lane;
- planting and landscape earthworks at the Trent North embankment and Brancote South cutting to limit visual impacts at residential properties and community resources in Ingestre, Little Ingestre and Tixall;
- access will be provided to residential properties at Park Farm, Stafford, via Trent Walk underbridge;
- planting at Hopton embankment and around the Trent Walk underbridge to reduce visual impacts at residential properties at Park Farm;
- access within the Staffordshire County Showground will be maintained via new internal roads;
- a pedestrian crossing of the route of the Proposed Scheme at Hopton (Hopton and Coton new footpath overbridge) to maintain connections between Mount Edge and the rest of the village. It is anticipated that this will be provided in

advance of works starting on the B5066 Sandon Road and Hopton Lane to avoid pedestrian severance effects;

- planting and a landscape bund to the south of Hopton to provide visual and acoustic screening to residential properties in the village; and
- the Marston South embankment satellite compound has been located close to the realigned Marston Lane to limit impacts on residential properties on the existing Marston Lane.

6.4.2 The draft Code of Construction Practice (CoCP)[68] includes a range of provisions that will help to mitigate community effects associated with construction of the Proposed Scheme within this area, including:

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

Assessment of impacts and effects

Temporary effects

Residential properties

6.4.3 It is necessary to carry out minor utility works or minor highways works associated with the construction of the Proposed Scheme within land which falls within the boundaries of residential properties. The scale of impact will be small, and the duration short (up to three months), resulting in minor adverse effects, which are not significant. A full description of the affected properties is included within Volume 5: Appendix CM-001-002.

6.4.4 A group of residential properties in Moreton will be in proximity to the construction of the Proposed Scheme. The works will include the construction of the Moreton North embankment and cutting, Colwich Bridleway 23 accommodation green overbridge and Moreton auto-transformer station. A site haul route will be provided to the north of Moreton North embankment, and south of Moreton North cutting. Residents of 10 residential properties will experience significant adverse visual effects due to views of cranes, construction vehicles and earthworks associated with the route of the

[68] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

Proposed Scheme. Seven of these residential properties will experience significant noise effects during the daytime due to earthworks, construction associated with the Moreton auto-transformer station and the movement of site vehicles. The noise and visual effects will result in an in-combination effect on amenity of residents of the seven properties for up to nine months in total. This will result in a major adverse effect, which is significant.

6.4.5 A group of approximately 11 residential properties on Tolldish Lane will be in proximity to the construction of the Proposed Scheme. The works will include the construction of the Trent South embankment and the A51 Lichfield Road underbridge. All 11 properties will experience significant noise effects during the daytime due to site establishment, earthworks and the movement of construction vehicles along the site haul route. Residents of all 11 properties will also experience significant adverse visual effects due to views of the works to construct the route of the Proposed Scheme; including views of the Trent South embankment main compound and temporary worker accommodation. A site haul route will be provided to the south of the Trent South embankment, to the rear of the six properties on the northern side of Tolldish Lane, which will result in significant increases in HGVs passing the properties on the northern side of Tolldish Lane. The noise and visual effects will result in an in-combination effect on the amenity of residents of the 11 properties, six of which will also experience HGV effects, for up to two years and 10 months in total. This will result in a major adverse effect, which is significant.

6.4.6 A group of approximately six remaining residential properties at Park Farm, Stafford, will be in proximity to the construction of the Proposed Scheme. The works will include the Hopton embankment and Trent Walk underbridge. The six properties will experience significant noise effects during the daytime due to earthworks, road works and the movement of vehicles along the site haul route located to the south of the route of the Proposed Scheme. Residents will also experience significant adverse visual effects due to earthworks associated with the Hopton embankment and stockpiles. The noise and visual effects will result in an in-combination effect on the amenity of residents of these properties for up to three years in total. This will result in a major adverse effect, which is significant.

6.4.7 A group of residential properties in Hopton will be located in proximity to the construction of the Proposed Scheme. The works will include the Hopton North cutting, which will cut through two parts of the village, the B5086 Sandon Road realignment, Mount Edge diversion and associated balancing ponds and mitigation planting. Approximately 60 residential properties on the edges of Hopton close to the route of the Proposed Scheme will experience significant adverse visual effects due to views of cranes and earthworks associated with the construction of the route of the Proposed Scheme, and elevated road works to the west. Approximately 11 residential properties will experience significant noise effects in the daytime and night-time due to demolitions, utility works, earthworks and other construction works. Site haul routes will result in significant numbers of HGVs passing approximately five properties. Within Hopton approximately 11 residential properties will experience visual and noise effects, with five of these additionally experiencing HGV effects. This will result in an in-combination effect on the amenity of residents of up to 11 residential properties for up to one year in total. This will result in a major adverse effect, which is significant.

6.4.8 An allocation for up to 3,100 homes (Policy Stafford North 2 – Housing) will be located in proximity to the construction of the Proposed Scheme. The works will include the Hopton North cutting and Marston South embankment. A site haul route will also be located to the south of the cutting and embankment. The properties that will be developed closest to the route of the Proposed Scheme will experience significant adverse visual effects due to views of the construction of the Hopton North cutting and temporary material stockpiles. In addition, the presence of site haul routes will result in significant numbers of HGVs passing some of the proposed properties. It is likely that the properties closest to the Proposed Scheme would also experience noise effects. The visual and HGV effects will result in an in-combination effect on the amenity of residents of some of these properties for up to eight months in total. This will result in a major adverse effect, which is significant.

6.4.9 A group of residential properties along Marston Lane will be located in proximity to the construction of the Proposed Scheme. The works will include the Marston South embankment and Marston Lane realignment; and the presence of Marston South embankment satellite compound. A site haul route will also be located to the south of the embankment. Approximately 11 residential properties will experience significant noise effects during the daytime due to site establishment, demolition, earthworks and the movement of vehicles along the site haul route. All 11 of these properties will experience significant visual effects due to close up views of construction activity, particularly earthworks construction vehicles. There will also be significant numbers of HGVs passing all of the residential properties along the site haul routes. The noise, visual and HGV effects will result in an in-combination effect on the amenity of residents of these 11 properties for up to one year and six months in total. This will result in a major adverse effect, which is significant.

Community facilities

6.4.10 A balancing pond associated with the Moreton North embankment, its access route and associated mitigation planting will be located within the northern-most field at Upper Moreton Farm. In total, approximately 3.1ha of land (12% of the farm) will be required for the construction of the Proposed Scheme. Of this, 0.2ha will be required temporarily for construction for approximately one month and will be returned to Upper Moreton Farm, while the remaining 2.9ha will be required permanently for the operation of the Proposed Scheme. This is reported under permanent effects. The land required temporarily will facilitate works to upgrade the access road to the balancing pond and for hedgerow planting. Access will be maintained to Upper Moreton Farm throughout the works, and this loss will not impede the use of other areas of Upper Moreton Farm. The temporary loss of a small area of Upper Moreton Farm will result in a minor adverse effect, which is not significant.

6.4.11 In addition, Upper Moreton Farm will be in proximity to the construction of the Proposed Scheme. Works will include the Moreton Brook viaduct and Moreton North embankment, the upgrade to Bishton Lane and the access road to the farm to provide access to a balancing pond and mitigation planting. Visitors will experience significant daytime noise effects with the potential for disturbance to activities that take place within the facility's classroom. Visitors will also experience significant adverse visual effects due to vegetation clearance, the presence of cranes and construction vehicles associated with the Moreton Brook viaduct and Moreton North embankment. The

noise and visual effects will result in an in-combination effect on amenity of visitors to Upper Moreton Farm for up to one year and nine months in total. This will result in a major adverse effect, which is significant.

6.4.12 Mayfield Children's Home will be in proximity to the construction of the Proposed Scheme. Works will include the Moreton North cutting, with the cutting within 40m of the property at its closest point. Colwich Bridleway 23 accommodation green overbridge will also be located near to the home, impacting on access. Residents will experience significant daytime noise effects, which will cause disturbance both internally and in the outside spaces. Residents will also experience significant adverse visual effects due to close range views of construction in the foreground, including stockpiles and vehicles moving along the site haul routes. The noise and visual effects will result in an in-combination effect on residents of Mayfield Children's Home for up to three years in total. This will result in a major adverse effect, which is significant.

6.4.13 During construction of Yarlet South cutting and the A34 Stone Road overbridge, approximately 0.4ha of outdoor land within the main grounds of Yarlet School will be required temporarily to allow safe access for school traffic along the temporary realignment of the A34 Stone Road until the A34 Stone Road overbridge is completed (approximately two years). Access will be maintained throughout the works and there will be no construction vehicles using the school's land. In addition, a small area of an informal playing field belonging to the school will be required for approximately one month to undertake utility works. This will not impact on the teaching activities at the school. The temporary loss of a small area of internal roadway and playing field will result in a minor adverse effect, which is not significant.

Recreational facilities

6.4.14 The construction of the Great Haywood viaduct and associated utility works will require approximately 2.5ha of land within the north and east of the Great Haywood Marina for approximately three years and three months. This land is used as amenity grassland ancillary to the main function of the marina, and an area of parking, which provides approximately 20 parking spaces. The total area of land required will be approximately 41% of the overall site, however this will not impact on the number of mooring stages available at the marina, and so will not change the ability of the recreational visitor to use Great Haywood Marina for mooring boats. There are a number of other basins in the area including Kings Bromley Marina, Hoo Mill Basin, Aston Marina, Streethay Wharf, and Kings Orchard Marina, which offer similar facilities. This will result in a minor adverse community effect, which is not significant.

6.4.15 Works to construct the Hopton South cutting and the A518 Weston Road realignment will require approximately 9.6ha (approximately 22%) of land from the Staffordshire County Showground. The main grandstand, showing areas, offices and function rooms within the site will not be impacted by the Proposed Scheme. The land required will include an area of car parking and a small section of Lower Berry Hill woodland. Visitors to the site will be unable to use these areas during construction, however the majority of the site will continue to function and remain accessible to visitors. The parts of the site that are used regularly by the community for meetings of the Young Farmers Club and Staffordshire Bridge Club will not be affected, and can continue to function as normal. The loss of parking has the potential to partly impair the use of the site for the Staffordshire County Show. Although this takes place only once a year, it is

an important local community event. Therefore, the temporary loss of approximately 22% of land at the Staffordshire County Showground for up to two years and nine months and the likely impact this will have on the Staffordshire County Show will result in a moderate adverse effect, which is significant.

Open space and public rights of way

6.4.16 Between Moreton Lane and Coley Lane, a section of the promoted PRoW Sabrina Way (Colwich Bridleway 35) is within land required for the construction of the Moreton cutting. During the construction period, a temporary alternative route for this section of the Sabrina Way will be provided. The footpath will be accessible throughout the construction period. This will result in a negligible adverse effect, which is not significant.

6.4.17 The Two Saints Way and St. John's School to Beacon Hill and Hopton Pools Doorstep Walk will be temporarily diverted for the construction of the Hopton cutting, with associated landscape earthworks, mitigation planting and temporary construction stockpiles. The footpaths will be accessible throughout the construction period. This will result in a negligible adverse effect, which is not significant.

6.4.18 The Stone Circles Challenge will be located within the area required to construct the Proposed Scheme in three locations: at the existing B5066 Sandon Road, at Hopton and Coton Bridleway 12 where it will be crossed by the Hopton North cutting, and at Marston Bridleway 8 where it is within land required for the construction of of the Marston South embankment and the Marston Lane diversion. Temporary diversions will be provided to ensure that the footpath will be accessible throughout the construction period. This will result in a negligible adverse effect, which is not significant.

Permanent effects

Residential properties

6.4.19 The construction of Moreton cutting will require the demolition of one residential property, Tithe Barn Farm (linked to the running of the farm of the same name), located south of Tolldish Lane and north of Coley. This residential property will be permanently lost.

6.4.20 The construction of the Trent South embankment will require the demolition of one residential property, Avondale (linked to the running of the farm of the same name), located north of Tolldish Lane, east of the A51 Lichfield Road. This residential property will be permanently lost.

6.4.21 The construction of Brancote South cutting will require the demolition of one residential property Upper Hanyards Farm, located on Hanyards Lane and linked to the running of the farm of the same name. This residential property will be permanently lost.

6.4.22 The construction of Hopton embankment will require the demolition of one residential property, Chase View located in the small hamlet situated around Park Farm, Stafford, to the east of Staffordshire County Showground. This residential property will be permanently lost.

6.4.23 The construction of Hopton North cutting and the diversion of Hopton Lane will require the demolition of nine residential properties on Hopton Lane in Hopton. The group includes 1 Mount Edge, Bank Cottages, Lower Bridge Farm, Long Meadow Cottage, 1, 2, 3 and 4 Mount Farm Barns and The Mount. These residential properties will be permanently lost. This will result in a major adverse effect, which is significant.

6.4.24 The construction of Yarlet South cutting, Yarlet express feeder auto-transformer station and its access, and the A34 Stone Road temporary diversion will require the demolition of two residential properties at Middle Bank Farm. These residential properties will be permanently lost.

Community facilities

6.4.25 Approximately 2.9ha of land will be required permanently from the northern-most field at Upper Moreton Farm for a balancing pond, its access and mitigation planting. This represents a permanent loss of approximately 11% of the land available for activities at the farm. This loss will limit the areas in which some activities can be undertaken, but will not impede the ability of the farm to undertake the majority of its activities. Due to the sensitivity of many of the users of Upper Moreton Farm, some users have a more limited ability to use other parts of the farm. This will result in a moderate adverse effect, which is significant.

6.4.26 In addition, an area of wildflower meadow at Lount Farm LWS located within the Fradley to Colton area (CA1) is located completely within the land required for the Moreton Brook viaduct (see Volume 2: Community area 1, Fradley to Colton). This area is used for nature walks and ecology training by Upper Moreton Farm and this use will be extinguished by the Proposed Scheme. These activities are only a small proportion of the activities undertaken at the farm, but they are important for the training programmes. A high proportion of users are particularly sensitive to change and this is the only facility of this type in the area. The loss of access to the wildflower meadow at Lount Farm LWS will result in a moderate adverse effect, which is significant.

Recreational facilities

6.4.27 Land at Great Haywood Marina will be required permanently for the piers of the Great Haywood viaduct to the north of the main basin. Access will be available beneath the viaduct to the remaining grass amenity area, which could continue to be used by visitors to the site. All of the parking currently available on site will be returned within the site. The permanent loss of the land will not impact on the ability of the marina to be used for recreation and access will remain to all parts of the site. This will result in a negligible adverse community effect, which is not significant.

6.4.28 Trent North embankment, Brancote South cutting and associated landscaping will require a total of approximately 24.5ha (approximately 47%) of Ingestre Park Golf Club to be either lost or severed from the club house during construction. This will result in the loss of seven holes of the course. There are alternative golf clubs in easy travelling distance, although there are no alternatives that will have similar qualities and characteristics in terms of the landscape and heritage value. The club house facilities are used for a variety of social and recreational events, including the local bridge club, and can cater for up to 200 people. This loss of land will mean that the club will be unable to function in its current arrangement. If the club closes, this will

result in a major adverse effect, which is significant. The Hopton cutting will permanently require a total of approximately 5.4ha (approximately 12%) of Staffordshire County Showground. The main grandstand, showing areas, offices and function rooms within the site will not be impacted by the Proposed Scheme. The land required will include an area used for car parking and camping, which will not be available to visitors permanently. The parts of the site that are used regularly by the community for meetings of the Young Farmers Club and Staffordshire Bridge Club will not be impacted, and can continue to function as normal. The loss of parking has the potential to partly impair the use of the site for the Staffordshire County Show. Although this takes place only once a year, it is an important local community event. Therefore, the permanent loss of approximately 12% of land at the Staffordshire County Showground and the likely impact this will have on the Staffordshire County Show will result in a moderate adverse effect, which is significant.

Open space and public rights of way

6.4.29 Sabrina Way (including Colwich Bridleway 35) will be crossed by the Moreton cutting between Moreton Lane and Coley Lane. Permanent diversions will be provided to ensure that the footpath is accessible permanently. Therefore, this will result in a negligible adverse effect, which is not significant.

6.4.30 The Two Saints Way (including Kings Drive, and Hopton and Coton Footpaths 1 and 6) and St John's School to Beacon Hill and Hopton Pools Doorstep Walk (including Hopton and Coton Footpath 23, 6 and 7) will crossed Hopton cutting Permanent diversions will be provided to ensure the footpaths are accessible permanently. Therefore, this will result in a negligible adverse effect, which is not significant.

6.4.31 Stone Circles Challenge (including Hopton and Coton Bridleway 11 and 12, and Marston Bridleway 8) will be crossed by the Hopton North cutting and Marston South embankment. Permanent diversions will be provided to ensure that the footpath is accessible permanently. Therefore, this will result in a negligible adverse effect, which is not significant.

Other mitigation measures

6.4.32 HS2 Ltd is continuing to engage with owners and operators of a number of facilities, including Mayfield Children's Home, Upper Moreton Farm, Ingestre Park Golf Club and Staffordshire County Showground, to identify reasonably practicable measures to help mitigate the likely significant effects identified in this assessment.

6.4.33 HS2 Ltd will endeavour to work with the developers of the site for residential properties north of Stafford and the local authority to design the development to avoid significant effects where possible, and identify reasonably practicable measures to help mitigate any likely significant effects.

Summary of likely residual significant effects

6.4.34 The construction of the Proposed Scheme will result in significant temporary in-combination effects on the following resources and receptors:

- Upper Moreton Farm due to the combination of noise and visual effects;

- approximately seven residential properties in Moreton due to the combination of noise and visual effects;
- Mayfield Children's Home due to the combination of noise and visual effects;
- eleven residential properties on Tolldish Lane due to the combination of noise, and visual effects, six of which will also have HGV effects;six residential properties at Park Farm, Stafford due to the combination of noise and visual effects;
- eleven residential properties in Hopton due to the combination of noise and visual effects, five of which will also have HGV effects;
- proposed homes at Stafford North due to the combination of noise, visual and HGV effects; and
- eleven residential properties in Marston due to the combination of noise, visual and HGV effects.

6.4.35 There will be permanent effects on communities due to the demolition of residential properties at Hopton. Land required for the Proposed Scheme will have permanent effects on Upper Moreton Farm, the Staffordshire County Show and Ingestre Park Golf Club.

Cumulative effects

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

6.4.37 In Moreton, there will be extensive works associated with the route of the Proposed Scheme as well as alterations to the main roads into the hamlet (Bishton Lane). The construction of the Proposed Scheme will impact on visitors to Upper Moreton Farm due to the loss of land, loss of access to other facilities and an in-combination effect. The majority of residential properties in the settlement will be subject to in-combination effects, including at Mayfield Children's Home. It is expected that the whole community of Moreton will be affected in some way during the construction of the Proposed Scheme, and this will therefore result in a community wide effect.

6.4.38 Park Farm, Staffordshire is a small hamlet of only seven residential properties. The route of the Proposed Scheme will be located within the southern part of the settment and will require the demolition of one of the residential properties. The main access into the settlement (Trent Walk) will be crossed by the route of the Proposed Scheme. Construction of the Proposed Scheme will require temporary rights of land from two of the remaining properties for utility works. It will also result in in-combination effects at all six of the remaining properties. It is expected that the whole community at Park Farm will be affected in some way during the construction of the Proposed Scheme, and this will therefore result in a community-wide effect.

6.4.39 In Hopton, the route of the Proposed Scheme will cross through two areas of the village, and there will be changes to the road network. The construction of the Proposed Scheme will result in the demolition of nine residential properties. It will also

result in in-combination effects at up to 11 residential properties, and require the diversion of three promoted public rights of way. It is expected that the majority of the community at Hopton will be affected in some way during the construction of the Proposed Scheme, and this will therefore result in a community wide effect.

6.4.40 In Marston and Yarlet, the route of the Proposed Scheme will run alongside the majority of the linear settlement. The construction of the Proposed Scheme will result in the demolition of two residential properties and require temporary rights of land from a further three residential properties as well as from Yarlet School for utility works. It will result in in-combination effects at approximately 11 residential properties and require the diversion of the Stone Circles Challenge. It is expected that the whole community in Marston and Yarlet will be affected in some way during the construction of the Proposed Scheme, and this will therefore result in a community wide effect.

6.5 Effects arising from operation

Avoidance and mitigation measures

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

- a noise fence barrier along the Moreton North embankment to provide acoustic screening at Moreton;
- a noise fence barrier along the Trent South embankment and Great Haywood viaduct to provide acoustic screening to residential properties and community facilities in Great Haywood, and canal boats at Great Haywood Marina and Hoo Mill Basin;
- a noise fence barrier along the Trent North embankment and Brancote South cutting to provide acoustic screening at Ingestre;
- a noise fence barrier along the Hopton South and Hopton North cuttings to provide acoustic screening at Hopton; and
- a noise fence barrier along the Marston South and Marston North embankments and a landscape noise bund to provide visual and acoustic screening at Marston and Yarlet.

Assessment of impacts and effects

Residential properties

6.5.2 Approximately 10 residential properties in Moreton will be in proximity to the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the residential properties during the daytime and night-time due to the running of the trains. All of the properties will experience significant adverse visual effects due to partial views of trains running along the route of the Proposed Scheme, overhead line equipment and the Moreton auto-transformer station. The noise and visual effects will result in a permanent in-combination effect on the amenity of

residents at these properties. This will result in a major adverse effect, which is significant.

6.5.3 Approximately seven residential properties at the junction of Tolldish Lane and Moreton Lane will be in proximity to the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the residential properties during the daytime and night-time due to the running of the trains. All of the properties will experience significant adverse visual effects due to mid-ground views of trains running along the route of the Proposed Scheme at the Trent South and Trent North embankments, and the Great Haywood viaduct. Noise fence barriers will partially screen the movement of trains within the view, but along with overhead line equipment will extend the height and visibility of the structures in the view. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.

6.5.4 A group of residential properties north of Great Haywood (on Hoo Mill Lane and at Lionlodge Covert) will be in proximity to the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the residential properties during the daytime and night-time due to the running of the trains. There will be views of the trains running along the route of the Proposed Scheme from the four residential properties on Hoo Mill Lane, and the southern-most property at Lionlodge Covert, which has a view out across a clearing in the trees. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.

6.5.5 Approximately six residential properties at Park Farm, Stafford will be in proximity to the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the residential properties during the daytime and night-time due to the running of the trains. All of the properties will experience significant adverse visual effects due to extremely close views of the Hopton embankment, including train movements, overhead line equipment and noise fence barriers at close range from the southern properties. The properties further north in the cluster will gain more benefits from the mitigation planting filtering views as it matures, however, visual effects will remain significant. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.

6.5.6 In Hopton, the operation of the Proposed Scheme will result in significant noise effects at approximately 99 residential properties during the daytime and night-time due to the running of the trains. Approximately 60 residential properties will experience significant adverse visual effects due to close up views of overhead line equipment and noise barriers in particular along the route of the Proposed Scheme at the Hopton North cutting, and views of vehicles passing along the new road network to the west of Hopton. Mitigation planting will filter views (particularly from the north) as it matures, however, visual effects will remain significant. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at approximately 60 properties. This will result in a major adverse effect, which is significant.

6.5.7 At the residential properties developed closest to the route of the Proposed Scheme within the allocation for up to 3,100 homes (Policy Stafford North 2 – Housing) the operation of the Proposed Scheme will result in significant noise effects during the daytime and night-time due to the running of the trains. The closest residential properties will experience significant adverse visual effects due to mid-ground views of the Hopton North cutting. Overhead line equipment and train movements will be visible in the skyline. Mitigation planting will mature over time to reduce visual impacts so that they are no longer significant. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at those properties built in proximity to the Proposed Scheme. This will result in a major adverse effect, which is significant.

6.5.8 A group of residential properties in Marston and Yarlet will be in proximity to the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at these residential properties during the daytime and night-time due to the running of the trains. These residential properties will also experience significant adverse visual effects due to views of trains running along the route of the Proposed Scheme at the Marston South embankment, Marston North embankment and to some extent Yarlet South cutting, introducing movement into the views. There will be close range views of planted landscape earthworks. Views would be increasingly filtered by planting as it matures, but views will remain significant. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents at these properties. This will result in a major adverse effect, which is significant.

Community facilities

6.5.9 Upper Moreton Farm will be located in proximity of the route of the Proposed Scheme at the Moreton Brook viaduct and Moreton North embankment. The operation of the Proposed Scheme will result in significant daytime noise effects, which may disturb activities within classrooms and outside teaching areas due to the running of the trains. Significant adverse visual effects will be experienced by visitors due to views of trains running along the route of the Proposed Scheme at the Moreton Brook viaduct and Moreton North embankment, introducing movement into the views, however, these will reduce slightly as vegetation matures. The noise and visual effects will result in a permanent in-combination effect on the visitors to Upper Moreton Farm. This will result in a major adverse effect, which is significant.

6.5.10 Mayfield Children's Home will be located in proximity to the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects, which will lead to activity disturbance and sleep disturbance for residents due to the running of the trains. Significant adverse visual effects will be experienced due to close up views of trains running along the route of the Proposed Scheme along the Moreton cutting, including overhead line equipment. The operation of the Proposed Scheme will be visible from both ground and upper floor windows, however, as planting matures it will partially screen views to the west. The noise and visual effects will result in a permanent in-combination effect on the amenity of residents of Mayfield Children's Home. This will result in a major adverse effect, which is significant.

6.5.11 St Leonards Church in Marston will be in proximity to the Proposed Scheme. The operation of the Proposed Scheme will result in significant noise effects at the church

during the daytime due to the running of the trains, which is expected to disturb the activities within the church. Visitors to the church yard will experience significant adverse visual effects due views of Marston South embankment, overhead line equipment and noise fence barriers and trains passing along the route, which will increase movement in the view. The noise and visual effects will result in a permanent in-combination effect on the amenity of visitors to St Leonards Church. This will result in a moderate adverse effect, which is significant.

Recreational facilities

6.5.12 No operational effects on recreational facilities are anticipated in this area.

Open space and public rights of way

6.5.13 No operational effects on open space or public rights of way are anticipated in this area.

Other mitigation measures

6.5.14 HS2 Ltd is is continuing to engage with Mayfield Children's Home and Upper Moreton Farm to identify reasonably practicable measures to mitigate the residual significant effects identified in this assessment.

Summary of likely residual significant effects

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

- Upper Moreton Farm due to the combination of noise and visual effects;
- ten residential properties in Moreton due to the combination of noise and visual effects;
- Mayfield Children's Home due to the combination of noise and visual effects;
- seven residential properties at the junction of Tolldish Lane and Moreton Lane due to the combination of noise and visual effects;
- five residential properties north of Great Haywood due to the combination of noise and visual effects;
- six residential properties at Park Farm, Stafford due to the combination of noise and visual effects;
- sixty residential properties in Hopton due to the combination of noise and visual effects;
- some residential properties at the proposed development at Stafford North due to the combination of noise and visual effects;
- thirty residential properties in Marston and Yarlet due to the combination of noise and visual effects; and
- St Leonards Church, Marston due to the combination of noise and visual effects.

Cumulative effects

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

6.5.17 In Moreton, the operation of the Proposed Scheme will impact on visitors to Upper Moreton Farm, residents of approximately 10 residential properties and residents of Mayfield Children's Home due to in-combination effects. It is expected that the whole community will be affected in some way during the operation of the Proposed Scheme, and this will therefore result in a community wide effect.

6.5.18 In Marston and Yarlet, the operation of the Proposed Scheme will affect residents of approximately 30 properties and visitors to St Leonards Church, due to in-combination effects. It is expected that the majority of the community will be affected in some way during the operation of the Proposed Scheme, and this will therefore result in a community wide effect.

Monitoring

6.5.19 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

6.5.20 There are no area-specific community monitoring requirements during operation of the Proposed Scheme. Any area-specific operational monitoring requirements in relation to air quality effects, noise and vibration effects, traffic effects and visual effects that have contributed to the in-combination assessments, are described in the relevant topic chapters.

7 Cultural heritage

7.1 Introduction

7.1.1 This section of the report provides a description of the current baseline for heritage assets and the likely impacts and significant effects resulting from the construction and operation of the Proposed Scheme within the Colwich to Yarlet area. Consideration is given to the extent and value (significance) of heritage assets including archaeological and palaeoenvironmental remains, historic buildings, the built environment and historic landscape.

7.1.2 Engagement has been undertaken with Historic England and Staffordshire County Council (SCC). The purpose of this engagement has been to understand the nature of heritage assets within the area, to obtain relevant baseline information and to inform the design development and assessment of the Proposed Scheme.

7.1.3 Throughout this section, heritage assets within the study area are identified with a unique reference code (for example COY001). Further detail on these heritage assets can be found in the gazetteer in Volume 5: Appendix CH-002-002. Detailed reports on cultural heritage baseline and historic landscape character within the Colwich to Yarlet area are contained in the Volume 5 Appendices. These are:

- Appendix CH-001-002 – Cultural heritage baseline report;
- Appendix CH-002-002 – Gazetteer of heritage assets; and
- Appendix CH-003-002 – Cultural heritage impact assessment table.

7.1.4 In addition there are two route-wide cultural heritage appendices:

- Appendix CH-005-000 – Historic landscape character report; and
- Appendix CH-006-000 – Geoarchaeological desk study report.

7.1.5 Maps showing the location of all designated and non-designated heritage assets can be found in Volume 5: Cultural heritage Map Book.

7.1.6 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

7.1.7 In addition, survey reports for the Colwich to Yarlet area, incorporating geophysical survey and remote sensing studies, are available in Background Information and Data (BID)[69] reports (BID-CH-004-002: Cultural heritage survey reports).

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

7.2 Scope, assumptions and limitations

7.2.1 The scope, key assumptions and limitations for the cultural heritage assessment are set out in full in Volume 1 (Section 8), the Scope and Methodology Report (SMR)[70], and the SMR Addendum[71].

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

7.2.3 The study area within which a detailed assessment of all assets, designated and non-designated, has been carried out is defined as the land required for the Proposed Scheme plus 500m. This is referred to in the remainder of this assessment as the 500m study area.

7.2.4 The setting of all designated heritage assets within the zone of theoretical visibility (ZTV) up to 2km from the land required for the Proposed Scheme has been considered. This is referred to in the remainder of this report as the 2km study area.

7.2.5 Impacts on the setting of heritage assets within the ZTV beyond 2km have been considered where professional judgement indicates that a significant effect may occur. No such impacts have been identified within the Colwich to Yarlet area.

7.2.6 The cultural heritage methodology includes the consideration of the intra-project effects of a number of topic assessments, for example, landscape and visual, ecology and biodiversity, and water resources and flood risk. Consequently, these interactions have been included in the assessment of impacts and effects.

7.2.7 Where noise is considered, this is within the context of the contribution that this makes to the heritage significance of the assets, and is not a reference to absolute noise levels or sound, or the noise or vibration impacts on the health and quality of life of people who live in or visit the area. Where measurements identified in the sound noise and vibration studies[72] indicate a significant effect, this has triggered an assessment of the contribution that tranquillity makes to the significance of the heritage asset.

7.2.8 The baseline studies informing this assessment have been drawn from a wide and comprehensive range of information sources. These have been supported by a programme of non-intrusive survey, including extensive geophysical survey.

7.2.9 Heritage assets within the land required to construct the Proposed Scheme are assumed to require complete removal and the assessment has been undertaken on that basis. With respect to overhead line diversions/realignments in particular, it is likely that the majority of the heritage assets can in fact be retained, as the land is only required to allow for raising or lowering of pylons and/or re-stringing of cables, or to provide an access route to the works.

[70] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report,
[71] Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.
[72] Volume 5: Appendix SV-002-002: CA2 Colwich to Yarlet, Sound, noise and vibration report, Tables 15 and 16.

7.2.10 Common features of the historic landscape such as marl pits, field boundaries and former areas of ridge and furrow are not individually considered and have not been included in the baseline, and impacts on them are not assessed individually. However, they are considered to contribute to the historic landscape character of the area and are considered within the overall assessment of impacts on historic landscape.

7.2.11 In undertaking the assessment, the following limitations were identified:

- although the (LiDAR[73]) data examined covers the majority of the 500m study area, there were some areas for which data was unavailable[74]; and
- not all areas within the 500m study area were available for field survey (due to limited land access or site conditions) such as site reconnaissance visits and geophysical survey[75].

7.2.12 Limitations in the LiDAR data were not considered to be of a scale or significance that would have any impact on the robustness of the assessment.

7.2.13 Where survey data are limited, a precautionary baseline has been built up according to the guidance reported in the SMR and the SMR Addendum.

7.3 Environmental baseline

Existing baseline

7.3.1 Documentary baseline data was collated from a variety of sources in compiling this assessment, as set out in Volume 5: Appendix CH-001-002, including:

- Staffordshire Historic Environment Record (HER)[76];
- Staffordshire Record Office collections;
- material held at the William Salt Library, Stafford;
- historic Ordnance Survey mapping; and
- other published sources (full references are provided in Volume 5: Appendix CH-001-002).

7.3.2 In addition to collating this baseline data, the following surveys were undertaken, as set out in the Background Information and Data document (see BID-CH-004-002: Cultural heritage survey reports):

- non-intrusive geophysical surveys;
- targeted fieldwalking surveys;
- detailed and systematic transcription of remote sensing data including LiDAR and aerial photographs;

[73] Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.
[74] For details see the Remote Sensing Survey Report in the Background Information and Data document, BID-CH-004-002.
[75] For details see the Geophysical Survey Report in the Background Information and Data document, BID-CH-004-002.
[76] Staffordshire Historic Environment Record. Available online at: https://www.staffordshire.gov.uk/environment/eLand/planners-developers/HistoricEnvironment/Historic-Environment-Record/HistoricEnvironmentRecord.aspx

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

Designated assets

7.3.3 The following designated heritage assets are located partially or wholly within the land required for the Proposed Scheme (see Volume 5: Cultural heritage Map Book: Maps CH-02-202b to CH-02-204a):

- Trent and Mersey Canal Conservation Area (COY037), and
- Ingestre Conservation Area (COY049).

7.3.4 The following designated heritage assets are located partially or wholly within the 2km study area (see Volume 5: Cultural heritage Map Book: Maps CH-02-202b to CH-02-204a):

- three scheduled monuments: a bowl barrow[77], approximately 360m east of Bishton Hall (COY013); a moated site[78] (COY014), approximately 160m south-west of St. Michael and All Angels' Church, Colwich; and St. Thomas' Priory, Baswich (COY083);
- eight Grade I listed buildings: six within Shugborough Park (COY034) - Shugborough Hall, the Chinese House, the Doric Temple, the Dark Lantern, the Triumphal Arch (COY036) and Essex Bridge (COY033); the Gatehouse of the former Tixall Hall (COY070); and the Church of St Mary, Ingestre (COY061);
- eleven Grade II* listed buildings: six within Shugborough Park (COY034) – White Barn Farm, buildings to the west of White Barn Farm, the walled garden and gardener's cottage, two buildings (the farmhouse and south range) at Shugborough Park Farm, and the Shepherd's Monument; Bishton Hall and the terrace, doric screen and parterre to the north (COY011 and COY012); the Church of St Michael and All Angels, Colwich (COY023); Ingestre Hall (COY063); and Weston Hall (COY074);
- seventy-four Grade II listed buildings predominantly within the settlements at: Bishton (COY012); Colwich (COY023, COY026, COY027); Little Haywood (COY028 and COY029); Great Haywood (COY030, COY032 and COY033); Shugborough (COY 034); Ingestre (COY052, COY057-COY060, COY064); Weston (COY073 and COY075); Salt (COY086); and Enson (COY122 and COY123);
- individual Grade II listed buildings comprising: Moreton House[79] (COY006) and the Church of St. Leonard in Marston (COY133);

[77] A prehistoric burial mound.
[78] A platform, generally square, surrounded by a ditch marking the former site of a medieval manorial/high status residence.
[79] Moreton House is also referred to as Mayfield Children's Home in this ES.

- A Grade I Registered Park and Garden, Shugborough Park (COY034);
- a registered battlefield - the site of the Civil War battle of Hopton Heath 1643 (COY099); and
- four further conservation areas: Great Haywood and Shugborough Conservation Area (COY041); Staffordshire and Worcestershire Canal Conservation Area (COY040); Tixall Conservation Area (COY071); and Colwich and Little Haywood Conservation Area (COY023).

Non-designated assets

7.3.5 All non-designated heritage assets within the 500m study area are listed in the gazetteer in Volume 5: Appendix CH-002-002 and identified on Maps CH-01-205b to CH-01-209a (Volume 5: Cultural heritage Map Book).

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

- cropmarks indicating buried archaeological remains of two Bronze Age round barrows and a field boundary of probable Iron Age or Roman date at Hoo Mill, Ingestre (COY045);
- a group of cropmarks on Pleistocene (Ice-Age) gravels to the west of the River Trent and to the east of Ingestre Park. This includes three possibly Bronze Age ring-ditches and extensive linear features indicative of a prehistoric field system, a possible trackway indicated by two parallel pit alignments and a possible square barrow (likely to be of Iron Age date) (COY048);
- buried archaeological remains of one probable and one possible Iron Age square barrow to the south of Lionlodge Covert, Ingestre, visible as cropmarks (COY054); and
- the site of the medieval Yarlet Hall, demolished and replaced by the current Yarlet Hall on a new site to the north during the 19th century. Concentric banks and ditches around the site of the hall could represent the remains of prehistoric defences (COY138).

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

- a group of cropmarks to the north of COY048, lying to the east of Little Ingestre, including at least one ring ditch[80] and various linear features (COY051);
- Upper Hanyards Farm, a non-designated farm on Hanyards Lane within the Tixall estate, shown on historic mapping dating back to 1775 (COY077);

[80] The circular cropmark remains of flattened round barrows.

- a group of cropmarks and geophysical anomalies indicative of a possible Romano-British enclosed settlement in fields to the south-east of Brickhouse Farm (COY148); and
- extensive earthworks indicative of medieval settlement at Marston, an area of earthworks approximately 600m east-west by 500m north-south. This asset has been significantly degraded by ploughing since 2003 (COY130).

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

- a possible prehistoric burial mound (COY001), Moreton Grange (COY004), earthworks relating to medieval cultivation (COY005), and a formal garden associated with Moreton House (COY007), all of which are in the vicinity of Morton House;
- early 19th century cottages adjacent to the historic location of Tithebarn Farm[81], shown on historic maps since the early 19th century (COY017);
- the site of Colwich tithebarn, shown to the west of the historic location of Tithebarn Farm on historic maps (COY018);
- the North Staffordshire Railway (COY031), which runs along the east side of the River Trent to the west of Great Haywood;
- remains of post-medieval water meadows in the Trent Valley to the north of Great Haywood (COY046);
- Hoo Mill at Ingestre, a renovated 19th century mill house on the site of a mill that may date back to 1086, formerly connected to the nearby canal wharf by a short tramway (COY044);
- a large group of cropmarks and earthworks on the golf course of Ingestre Park Golf Club, to the south of Ingestre Hall, relating to the medieval/post-medieval landscape (COY053);
- Ingestre New Park, the southern portion of Ingestre Park, laid out in the early 19th century, including a tree-lined drive from Lion Lodge to Ingestre Hall, now largely incorporated into Ingestre Park Golf Club (COY145);
- Ingestre Park boundary, a series of earthwork features marking the western boundary of Ingestre Park(COY080);
- a finger post on Hoo Mill Lane, Tixall (COY056);
- the historic extent of Tixall Park (COY149);
- group of cropmarks in the fields within the former area of Tixall Park (COY066);

[81] This is also shown on OS mapping as Tithe Barn Farm.

- Upper Hanyards Quarry immediately south of Upper Hanyards Farm (COY078);
- earthwork features in the field to the east of Upper Hanyards Farm (COY079);
- a 19th century cast iron milepost on the south-east side of the A518 Weston Road to the north of Staffordshire County Showground (COY088);
- an area of surviving ridge and furrow to the north of Hopton Pools (COY094);
- earthworks, possible evidence for medieval settlement, on a plot on the south side of Hopton Lane (COY102);
- an area of surviving ridge and furrow to the south of historic core of Hopton (COY103);
- two earthwork enclosures to the south-west of Mount Farm, Hopton (COY 104);
- an area of surviving ridge and furrow earthworks to the north of Hopton Lane (COY106);
- a group of linear geophysical anomalies to the north-west of Hopton (COY107);
- Mount Farm at Hopton, an L-shaped range of 19th century brick buildings (COY108);
- Lowerbridge Farm[82] at Hopton, a group of renovated historic brick buildings on the north side of Hopton Lane (COY109);
- remains of the former Stafford and Uttoxeter Railway to the west of Hopton (COY110);
- linear geophysical anomalies to the north-east of Newbuildings Farm (COY118);
- surviving ridge and furrow and associated earthworks to the north of Newbuildings Farm (COY121);
- early post-medieval field system to the north of Marston (COY129);
- surviving ridge and furrow earthworks to the north-west of Marston deserted medieval village (DMV) (COY135);
- former trackway, running north-south through the historic settlement at Yarlet to the east of the A34 Stone Road (COY139);
- surviving ridge and furrow earthworks at Yarlet, to the west of the A34 Stone Road (COY141); and
- the historic estate boundary at Yarlet (COY142).

[82] This is also shown on OS mapping as Lower Bridge Farm.

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

- Upper Moreton Farm, a 19th century farmstead (COY002);
- Moreton Farm, shown on maps dating back to the late 18th century (COY008);
- a possible moated site to the west of Moreton Farm (COY009);
- a group of brick, 19th century farm buildings to the north of Moreton House (COY010);
- a 19th century former tollhouse at the western end of Tolldish Lane (COY025);
- Ingestre Hall Park, an 18th century formal landscape to the north of Ingestre Hall (COY144);
- Weetman's ring ditch, a possible Bronze Age burial mound situated to the east of the Staffordshire County Showground (COY081);
- Brickhouse Farm at Hopton, the location of a late 18th century farm shown on maps from then onwards (COY087);
- Hopton Pools, shown on maps dating back to at least the late 18th century (COY090);
- Lowerhouse Farm at Hopton, a late 18th century farmhouse and 19th century farm buildings (COY100);
- Hopton historic village (COY101);
- Kent's Barn Farm at Hopton, an early 19th century farmstead (COY117);
- Newbuildings Farm at Hopton, a farmstead dating from the late 18th to early 19th century (COY119);
- Hollytree Farm at Marston, an isolated linear-plan farmstead to the north of Marston (COY127);
- Marston New Farm, a substantial courtyard farm on Yarlet Lane, to the west of Marston DMV (COY134);
- a group of earthworks, likely to represent a medieval settlement centred on Yarlet Hall (Yarlet School) (COY137); and
- Yarlet Hall, a 19th century manor house used as a preparatory school (Yarlet School) (COY140).

Historic landscape

7.3.10 Analysis has been undertaken of the historic landscape character within and around the land required for the Proposed Scheme. This was based on the outputs of the SCC Historic Landscape Characterisation (HLC), geological and geographical data sources, site visits and professional judgement. For the purpose of assessment, the Proposed Scheme has been divided into a number of Historic Landscape Character Areas

(HLCAs) (see Volume 5: Appendix CH-005-000). Within the Colwich to Yarlet area these are as follows:

- HLCA 5 Colwich, Hixon and the Haywoods. This HLCA comprises rolling farmland to the north and east of the Trent Valley either side of its confluence with the River Sow. The area is largely arable, with occasional blocks of woodland. It includes a number of historic settlements on the fringes of the Trent Valley. Modern development and the effect of modern farming techniques mean the heritage value of this HLCA is considered to be moderate;

- HLCA 6 Shugborough Park. This HLCA comprises a well-preserved mid to late 18th century designed landscaped park, now a leisure resource. The park descends from the wooded northern fringes of Cannock Chase down to the gravel and Alluvium floodplain at the confluence of the Rivers Sow and Trent. As well as a large neo-classical mansion, the Park contains a farm, a formal garden and numerous ornamental buildings. Given the concentration of high value assets and the ongoing preservation of the designed landscape the heritage value of this HLCA is considered to be high;

- HLCA 7 Trent Valley and Weston. This HLCA falls within the section of the Trent Valley where the river runs north before turning to the north-west at Hixon. The potential of the river to provide power and transport is reflected in the presence of Hoo Mill (COY042), which probably dates back to at least 1086. The floodplain character of the area is reflected in traces of historic water meadow drainage features (COY046). Industrial transport infrastructure follows the River Trent in this area, as elsewhere, in the form of the Trent and Mersey Canal (COY037), the North Staffordshire Railway (COY031) and the A51 Lichfield Road. Given its distinctive historic character, while taking into account modern development, the heritage value of this HLCA is considered to be moderate;

- HLCA 8 Tixall and Ingestre Parklands. This HCLA extends from the north-western boundary of Shugborough Park across the former landscape parks of Ingestre and Tixall beyond the River Sow. These lie on high ground, which forms a watershed between the River Trent to the north and east from the River Sow to the south and west. The historic development of these estates ran in parallel, with the construction of substantial aristocratic mansions in the Tudor and Jacobean periods and the incorporation of medieval deer parks into large designed landscapes in the 18th century. After the estates were sold in the 20th century, Tixall Hall was demolished and the parkland landscapes were divided and have lost much of their legibility and coherence. Given the changes to the parkland landscapes, the heritage value of this HLCA is considered to be moderate;

- HLCA 9 Hopton and Salt. The solid geology and topography of this HCLA mean that its soils are less amenable to traditional farming techniques than adjacent areas to the west and east. Patches of historic woodland indicate that this area included extensive heathland until the later 19th century, including Hopton Heath, a registered battlefield site. The relatively poor agricultural

quality of the land has led to it being used for development in recent years on the fringes of Stafford and at Hopton Heath. Given the distinctive character of the area, the heritage value of this HLCA is considered to be moderate; and

- HLCA 10 Marston and Yarlet. This HLCA covers a ridge of high ground to the north of Stafford, with underlying mudstone/siltstone geology producing relatively heavy, poorly draining soils. The ridge runs broadly south-east to north-west, reaching its highest point at Yarlet, rising again at Pirehill to the south of Stone. This is an area that contains extensive traces of early enclosure, as well as earthwork traces of medieval cultivation and settlement. Earthwork evidence for medieval settlement survives at both Marston and Yarlet. Given the relatively high historic legibility and time depth of the landscape, the heritage value of this HLCA is considered to be moderate.

Cultural heritage overview

7.3.11 This overview of the cultural heritage baseline is drawn from the more detailed analysis set out in the Baseline Report (see Volume 5: Appendix CH-001-002). This also contains references and a timeline setting out the chronological limits of the periods referred to below. This overview refers to heritage assets within the wider 500m study area, unless specified otherwise.

7.3.12 There are a number of river and stream valleys along the route of the Proposed Scheme containing Pleistocene (Ice Age) River Terrace Deposits and/or deposits of Holocene (post-Ice Age) Alluvium. The largest, and that with the greatest potential for archaeological significance, is Trent Valley. The upper Trent Valley is known to contain Pleistocene terrace gravels dating back to around 450,000 years ago, which have the potential to contain stone tools as well as important palaeoenvironmental information. Overlying this, Holocene Alluvium and waterlogged peat have the potential to contain exceptionally well-preserved prehistoric archaeological and palaeoenvironmental remains dating back over the past 10,000 years. The valleys of Moreton Brook and Hopton Brook are also known to contain similar Holocene deposits.

7.3.13 There are no certain Mesolithic sites identified within the study area, although remains of this date have been recovered from sites in the immediate vicinity. An axe-hammer and arrowhead of Neolithic date were found beside Hopton Pools (COY090), Neolithic axes have been found in the Trent Valley near Little Ingestre (COY048) and other artefacts of this date were recovered from the Pool Farm area of Weston in the 1950s (COY089). Beyond the study area there are two causewayed enclosures of Neolithic date, downstream within the Trent Valley at Mavesyn Ridware and Alrewas, and a possible Neolithic mortuary enclosure is known at Pipe Ridware. There is cropmark evidence of two Bronze Age round barrows within the land required for the Proposed Scheme on the Trent gravels near Hoo Mill, Ingestre (COY045), and two or three additional barrows of that date to the east of Little Ingestre (COY048) within 500m of the route for the Proposed Scheme. There were formerly two additional Bronze Age round barrows on Tixall Heath (King's Low and Queen's Low (COY076)), which were subject to archaeological excavation ahead of removal in the 1980s and 1990s. Traces of two ring ditches have been found at Berryfields, just east of the Staffordshire County Showground (COY148). Mounds at Moreton Brook (COY001),

near Bishton Hall (COY013) and beside Hopton Brook (COY093) could also be remains of Early Bronze Age burials.

7.3.14 One probable and one possible Iron Age square barrow are visible as cropmarks within the land required for the Proposed Scheme, to the east of Little Ingestre (COY048) and to the south of Lionlodge Covert (COY054). There are also numerous pit alignments and continuous ditch boundaries and enclosures of probable Iron Age or Roman date within the land required for the Proposed Scheme and the wider 2km study area and beyond. These reflect intensive settlement and agricultural occupation, which appears to have extended across the river valleys and up onto the adjacent valley slopes.

7.3.15 There are no known remains of early or mid-Anglo Saxon date within or adjacent to the study area. By the end of the Anglo Saxon period, the essential settlement pattern of the study area that would exist throughout the medieval period was probably already established. The Domesday Book indicates that there were two estates present by 1086 at Moreton, likely to have been centred upon modern-day Moreton Farm (COY008) and upon Upper Moreton (COY002), which lies 500m south-east of Moreton Grange. These two estates were small, and likely to have been no more than hamlets at that time. Great Haywood was a large estate in 1086, likely to be associated with an already medium-sized nucleated village. At Ingestre, Tixall, Hopton, Marston and Yarlet there was a single estate in each township, and the settlements there are likely to have been small nucleated hamlets.

7.3.16 Each of these settlements is likely to have prospered and expanded between the 11th and early 14th centuries, with the exception of the settlement at Yarlet, which was depopulated by the Cistercian monks of Combermere who turned it into a grange (a monastic farm) probably in the mid 12th century. In the late medieval period, it is likely that Moreton contracted. The site of possible deserted medieval settlement has been identified close to Moreton Farm (COY008). Marston village (COY130) may also have been deserted at this time, and the earthwork remains of the village survive in fields to the north, south and east of the parish church. Similarly, there are indications that Hopton experienced contraction in the late medieval period, with the loss of its church and evidence of medieval settlement around the fringes of the modern village (COY102, COY104).

7.3.17 In the post-medieval period, the enclosure of the former open fields in the area was completed. Many farmsteads previously located within villages or hamlets dispersed to their now consolidated landholdings, and it is to the post-medieval period that the dispersed farmsteads within the study area date. This period also saw the rise of country houses and the laying out of their parks and gardens, including those at Tixall, Ingestre and Shugborough.

7.3.18 The post medieval Tixall Hall was built around 1560, and the associated Grade I listed Tixall Gatehouse (COY070) was built approximately 15 years later. Bottle Lodge (COY067), located approximately 500m east of the Hall, may be contemporary with the Gatehouse. In the Tudor period, the hall was associated with a deer park located a short distance to the north-west. In August 1586, the hall was the temporary prison of Mary Queen of Scots, while her quarters at Chartley were being searched for incriminating evidence.

7.3.19 In the 18th century, the post medieval Tixall Hall was demolished and a Georgian country house was built a short distance to the east. This faced south towards the Trent Valley. Consent was given to build the Staffordshire and Worcestershire Canal (COY040) through the estate on condition that where the canal would run past the Georgian Hall it would be widened, to give the illusion of a lake when viewed from the Hall. Thus in 1771, Tixall Wide was formed. Lancelot 'Capability' Brown remodelled the landscape park at this time, levelling the ground between the Hall and Tixall Wide to enhance the view. The Georgian Hall was demolished in the 1920s, although the Tudor Gatehouse (COY070), Bottle Lodge (COY067) and the 19th century stables (COY069) built behind the main house survive.

7.3.20 The Jacobean Grade II* Ingestre Hall (COY063) was built in around 1613, and in 1676 St. Mary's Grade I listed church (COY061) was built adjacent to the Hall to a design by Christopher Wren (this is the only Christopher Wren church to be built outside London). Celia Fiennes, writing in the late 17th century, described formal gardens surrounding the Hall, and a tree lined avenue one mile long running north/north-west from the hall to Old Lodge Covert[83]. In the early 18th century, a walled wilderness was laid out in Ingestre Wood to the north-west of the Hall, with formal grand walks and radiating alleys. A number of classical buildings were erected in the wilderness at this time, the only surviving one of which is the Pavilion. The formal gardens surrounding the Hall were removed in the early 18th century and Capability Brown naturalised the parkland to the north by removing or softening the geometric planting. The parkland to the south of the Hall, where crossed by the route of the Proposed Scheme, would appear to have been integrated into the landscape park more fully in the 19th century, after the road in front of the Hall, continuing the line of Hanyards Lane, was closed in 1802.

7.3.21 The Grade I listed Shugborough Hall (COY035) lies approximately 600m at its nearest point from the land required for the Proposed Scheme. It was built in the late 17th century, and was remodelled and amended in the 18th century and early 19th century. The Hall is located within a Grade I registered park and garden (COY034) that contains a number of nationally important early to mid 18th century garden buildings, including the Chinese House, the Ruins, the Shepherd's Monument and Cat's Monument. The parkland beyond contains a number of nationally important mid 18th century Neo-classical Greek parkland buildings and monuments designed by James 'Athenian' Stuart, including the Triumphal Arch (COY036), the Tower of the Winds, the Dark Lantern and the Doric Temple (these latter three all being grouped under COY034).

7.3.22 A 17th century manor house at Yarlet (COY138), the probable site of which falls within the land required for the Proposed Scheme, was demolished in the mid 19th century.

7.3.23 The post-medieval period also witnessed the turbulent events of the English Civil War (1642 - 1651). The south-eastern corner of the Hopton Heath 1643 registered battlefield site (COY099) falls within the study area, to the east of Ministry of Defence (MoD) Stafford, which is located within the boundary of the asset.

7.3.24 The Trent and Mersey Canal (COY037) was authorised by Parliament in 1766 and completed in 1777. The Staffordshire and Worcestershire Canal (COY040) was also

[83] Morris, C., ed. (1947), *The Journeys of Celia Fiennes*. London: The Cresset Press.

authorised in 1766 and completed in 1772. The Trent Valley Line Railway (now part of the West Coast Main Line), which runs through the study area, opened in 1848. The Stafford and Uttoxeter Railway (COY110) opened in 1867 and closed in 1951. It crossed the route of the Proposed Scheme on the west side of Hopton.

7.3.25 The 20th century witnessed significant changes in landscape character within the study area. The Georgian Tixall Hall was demolished and Ingestre Hall and Shugborough Hall ceased to be domestic residences at this time. The designed landscapes of Tixall Hall and Ingestre Hall were converted to agricultural or leisure use. The Shugborough estate was donated to the National Trust in 1960. In the middle and later years of the 20th century, the increased mechanisation of farming led to the amalgamation of many small fields with the consequential loss of historic hedgerows, for example at Colwich and Hopton. The past 20 years has seen widespread loss of historic earthworks, such as ridge and furrow, as a result of ploughing of former areas of pasture, as at Marston.

7.3.26 A number of military establishments were built along the route of the Proposed Scheme in the middle decades of the 20th century, such as the former military depot at Ingestre and the Second World War RAF air fields at Hixon and Stafford. Most of the villages and many of the hamlets within the study area expanded during the 20th and 21st centuries, as settlements serving the rural economy transitioned to dormitory settlements, increasingly housing people who worked in the region's towns, such as Rugeley, Stafford and Stone.

Future baseline

Construction (2020)

7.3.27 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2020.

7.3.28 No committed developments have been identified in this area that will materially alter the baseline conditions in 2020 for heritage assets.

Operation (2027)

7.3.29 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2027.

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

7.4 Effects arising during construction

Avoidance and mitigation measures

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

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

- construction of Ingestre green overbridge at the historic boundary of Ingestre and Tixall parks/parishes, on a precautionary basis for reasons of ecological connectivity, will also maintain a key feature of the historic landscape and therefore reduce the effect on the Tixall and Ingestre Parklands HLCA;
- tree planting to the north of Moreton Grange (COY004) which will reduce the effect to its setting;
- a retaining wall will be constructed on the north side of Moreton cutting which will reduce the amount of land required from Moreton House garden (COY007);
- planting on the north side of Moreton cutting which will reduce the effect on Moreton House (COY006);
- planting on the Trent South embankment which will reduce the effect on Great Haywood and Shugborough Conservation Area (COY041) and the Shugborough Park Grade I registered park and garden (COY034), including the Triumphal Arch (COY036); and
- planting which will reduce the effect on the Ingestre Conservation Area (COY049).

7.4.3 Section 8 of the draft Code of Construction Practice[84] (CoCP) sets out the measures that will be adopted, insofar as reasonably practicable, to control effects on heritage assets. These include:

- management measures that will be implemented for heritage assets that are to be retained within the land required for the Proposed Scheme;
- route-wide principles, standards and techniques for works affecting heritage assets; and
- a programme of historic environment investigation and recording (including archaeology and historic buildings) to be undertaken prior to or during construction works affecting the heritage assets.

Assessment of impacts and effects

7.4.4 Impacts on all heritage assets described above have been assessed[85]. However, only those leading to significant effects are described in the construction assessment set out below.

Temporary effects

7.4.5 The construction works, comprising excavations and earthworks and including temporary works such as construction compounds, storage areas, and diversion of existing roads and services, have the potential to affect heritage assets during the construction period. Impacts will occur to assets both within the land required for the

[84] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.
[85] These are set out in detail in the Impact Assessment Table, Volume 5: Appendix CH-003-002, Cultural heritage impact assessment table.

Proposed Scheme and assets in the wider study area due to the visibility of plant, cranes and equipment.

7.4.6 The following significant effects are expected to occur as a result of temporary impacts on designated or non-designated heritage assets due to changes to their settings.

7.4.7 Moreton Grange (COY004), an asset of low value, will be subject to a temporary change in its setting. It is a substantial 18th/19th century farm with extensive outbuildings situated on the lane leading south-east from Moreton towards Colton. Construction activity associated with the Moreton North embankment and the Moreton cutting will be approximately 15m from the farmyard buildings and the farmstead. Construction activities will introduce noise and visual impacts into the quiet rural setting of the heritage asset. This will constitute a high adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately two years and nine months.

7.4.8 Moreton House (COY006), an asset of moderate value, will be subject to a temporary change in its setting. It is a substantial hilltop late 18th century house, originally set within a historic formal garden (COY007), with its main façade looking south in the direction of the route of the Proposed Scheme. Views across fields to the south of the building will be obstructed during construction of the Moreton cutting and retaining wall, with the land required for construction approximately 15m from the main façade of Moreton House, within the boundary of its historic garden. Construction activities will also introduce noise impacts into the rural environment of the house, affecting its rural character. This will constitute a high adverse impact and a major adverse significant effect. Construction activity will take place over approximately two years and nine months.

7.4.9 The Trent and Mersey Canal Conservation Area (COY037), an asset of moderate value, will be subject to a temporary change in its setting where the route of the Proposed Scheme will cross it to the north of Great Haywood and while temporary site haul route crossings are in use. The most significant elements of the setting of the canal in this section of the Trent Valley lie in its relationship to the surrounding largely rural river valley landscape, as well as the roads and river that run parallel to it. Construction of the Great Haywood viaduct across the Conservation Area will introduce noise and visual impacts into the setting. This will constitute a medium adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately three years and three months.

7.4.10 Ingestre Conservation Area (COY049), an asset of moderate value, will be subject to a temporary change in its setting. The most significant elements of its setting include outward and inward views from Ingestre Park's historic perimeter and the key buildings associated with it, as well as its historic relationship with Tixall Park to the south. Construction activity will be visible from the eastern boundary of the conservation area during the construction of the Trent North embankment and the Brancote South cutting and will introduce noise into its quiet rural setting. This will constitute a medium adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately three years.

7.4.11 Lowerhouse Farm, Hopton (COY100), an asset of low value, will be subject to a temporary change in its immediate farmyard setting. It is situated on the southern fringe of Hopton, and the foot of the high ground looking south-west towards Beacon Hill. The land required for the Proposed Scheme will lie within the farmyard depicted on the 1902 Ordnance Survey mapping, approximately 70m from the farmhouse and less than 10m from the farmyard buildings. Activities associated with the construction of Hopton South cutting will introduce noise and visual impacts into the quiet rural farmyard setting of the asset. This will constitute a high adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately two years and three months.

7.4.12 The Church of St. Leonard, Marston (COY133), an asset of moderate value, will be subject to a temporary change in its setting. It is located in a quiet rural setting, surrounded by fields of pasture containing earthwork remains of the medieval settlement of Marston. The land required for of the Proposed Scheme will lie just over 100m to the north of the church. The northern side is the principal side of the church, in that access is gained to the church through the churchyard that lies to the north of the church. Activities associated with the construction of the Hopton South cutting will introduce noise and visual impact into the quiet rural setting of the church. This will constitute a medium adverse impact and a moderate adverse significant effect. Construction activity will take place over approximately one year and nine months.

7.4.13 The following significant effects will occur as a result of temporary impacts on HLCAs with the Colwich to Yarlet area:

- HLCA 7 Trent Valley and Weston to the north of Great Haywood, already contains extensive industrial transport infrastructure, including significant canal, railway and road routes. The construction of the Trent South embankment and Great Haywood viaduct running across the HLCA will involve large scale earth-moving and construction work over approximately three years and three months. This will involve the introduction of movement, noise and large scale plant into what remains a largely rural landscape leading to a medium adverse impact. Given that the HLCA is an area of moderate value, this will result in an overall moderate adverse significant effect;

- The former parklands of HLCA 8 Tixall and Ingestre Parklands are preserved to be clearly identifiable as a remnant designed landscape. Construction of the Trent North embankment and Brancote South cutting will run across portions of both parks, cutting obliquely through the historic boundary between them. This will involve the introduction of movement, noise and large scale plant over a period of approximately three years and three months leading to a medium adverse impact. Given that the HLCA is an area of moderate value, this will result in an overall moderate adverse significant effect; and

- HLCA 10 Marston and Yarlet is an area of farmland with considerable time-depth, notably early medieval earthworks and boundaries at Marston and Yarlet. The construction of the Marston South and North embankments and the Yarlet South cutting will involve large scale earth-moving and construction work over approximately three years. This will involve the introduction of movement, noise and large scale plant into what remains a largely rural

landscape leading to a medium adverse impact. Given that the HLCA is an area of moderate value, this will result in an overall moderate adverse significant effect.

Permanent effects

7.4.14 Permanent significant effects can occur either as a result of physical impacts on heritage assets within the land required for the Proposed Scheme, or through changes to the setting of heritage assets through the presence of the Proposed Scheme.

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

7.4.16 The ha-ha[86] marking the southern boundary of the remnant late 18th/early 19th century formal garden (COY007) around Moreton House, an asset of low value, will be removed during construction of the Moreton cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.17 Tithebarn Farm cottages (COY017), an asset of low value, will be demolished due to the construction of the Moreton cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.18 The site of Colwich tithebarn and associated buried remains (COY018), an asset of low value, will be removed during the construction of the Moreton cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.19 Cropmarks indicating buried archaeological remains of two Bronze Age round barrows and a field boundary of probable Iron Age or Roman date at Hoo Mill, Ingestre (COY045), assets of high value, will be partially removed during major utility works. This will constitute a high adverse impact and a major adverse significant effect.

7.4.20 Remnants of post-medieval water meadows in the Trent valley to the north of Great Haywood (COY046), assets of low value, will be removed during construction of the Great Haywood viaduct. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.21 A group of cropmarks to the east of Little Ingestre (COY048), including a group of possible barrows and a remnant prehistoric field system, assets of high value, will be partially affected by diversion works to a major utility. This will cut across the eastern edge of the group removing a number of ditches and a double pit alignment. This will constitute a high adverse impact and a major adverse significant effect.

7.4.22 Buried archaeological remains of one probable and one possible Iron Age square barrow to the south of Lionlodge Covert (COY054), assets of high value, will be removed during construction of the Trent North embankment. This will constitute a high adverse impact and a major adverse significant effect.

7.4.23 A finger post at the junction of Hoo Mill Lane and Mill Lane to the south-east of Lionlodge Covert (COY056), an asset of low value, will be removed during

[86] A sunken ditch designed to prevent animals from entering the garden.

construction of the Great Haywood viaduct. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.24 A large group of cropmarks and earthwork features on the golf course of Ingestre Park Golf Club (COY053), assets of low value, will be partially removed during the construction of the Brancote South cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.25 The southern part of the recently extended Ingestre Conservation Area (COY049), an asset of moderate value, will be cut across by the Proposed Scheme at two points. The Trent North embankment will remove the southern part of Lionlodge Covert and, further west, the Brancote South cutting will impinge on the southern edge of Ingestre Wood adjacent to The Mounts. These impacts together will constitute a medium adverse impact and a moderate adverse significant effect.

7.4.26 Surviving landscape elements of Ingestre New Park to the south of Ingestre Hall (COY145), an asset of low value, including the remains of the drive/avenue leading to the hall from Lionlodge, will be partially removed during the construction of the Brancote South cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.27 A group of cropmarks in the fields of the former Tixall Park (COY066), assets of low value, will be removed during construction of the Brancote South cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.28 Upper Hanyards Farm (COY077), an asset of moderate value, will be removed during construction of the Brancote South cutting. This will constitute a high adverse impact and a major adverse significant effect.

7.4.29 Upper Hanyards Quarry (COY078), an asset of low value, will be removed during construction of the Brancote South cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.30 A group of cropmarks and geophysical anomalies indicative of a Romano-British enclosed settlement in fields to the south-east of Brickhouse Farm (COY148), assets of moderate value, will be partially removed during construction of the Hopton embankment. This will constitute a high adverse impact and a major adverse significant effect.

7.4.31 An area of surviving ridge and furrow to the north of Hopton Pools (COY094), an asset of low value, will be partially removed during construction of a landscape bund to the north of the Hopton South cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.32 An area of surviving ridge and furrow to the south-west of Mount Farm, Hopton (COY103), assets of low value, will be removed during construction of the Hopton North cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.33 An area of surviving ridge and furrow to the north of Hopton Lane (COY106), assets of low value, will be removed due to grassland habitat creation. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.34 A group of 19th century brick buildings at Mount Farm, Hopton (COY108), assets of low value, will be removed during construction of the Hopton North cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.35 A group of renovated historic brick buildings at Lowerbridge Farm, Hopton (COY109), assets of low value, will be removed during construction of the Hopton North cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.36 Linear geophysical anomalies to the north-east of Newbuildings Farm, Hopton (COY118), assets of low value, will be removed during construction of the Hopton North cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.37 Surviving ridge and furrow and associated earthworks, to the north of Newbuildings Farm (COY121), an asset of low value, will be partly removed during construction of the Hopton North cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.38 Earthwork features to the south of Marston Lane that form part of Marston DMV (COY130), assets of moderate value, will be removed during construction of the Marston South embankment. This will constitute a high adverse impact and a major adverse significant effect.

7.4.39 Cropmark features, including surviving ridge and furrow and field boundaries to the north and north-west of Marston (COY129), an asset of low value, will be removed during construction of the Marston South embankment. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.40 The site of the 17th century Yarlet Hall (COY138), predecessor of the surviving 19th century house (COY137), which is marked by a earthworks, possibly including a defensive bank and ditch, an asset of high value, will be removed during construction of the Yarlet South cutting. This will constitute a high adverse impact and a major adverse significant effect.

7.4.41 Traces of an incised trackway running through the historic settlement of Yarlet to the east of the A34 Stone Road (COY139), an asset of low value, will be removed during construction of the Yarlet South cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.42 The historic estate boundary that runs around the historic settlement at Yarlet (COY142), an asset of low value, will be partially removed during construction of the Yarlet South cutting. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.43 The following significant effects will occur as a result of the permanent impacts on designated or non-designated heritage assets as a result of changes to their settings.

7.4.44 Moreton Grange (COY004), an asset of low value, will be subject to a permanent change in its setting. The most important elements of its setting lie in its relationships with surrounding fields and other rural settlements, notably Moreton Farm and House to the north-west. The western end of the Moreton North embankment will be located approximately 75m to the north of the farmstead. Tree planting to the north of the building will be undertaken in order to reduce the effect to its setting. The rural

character of the surroundings of the farmhouse will be fundamentally changed by the Proposed Scheme. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.45 Moreton House (COY006), an asset of moderate value, will be subject to a permanent change in its setting. The house faces south across the garden, the southern boundary of which is planted with oak trees, and forms an important part of its designed setting. The Moreton cutting will be approximately 40m from the house and in full view of the southern aspect of the building. There will be planting on the north side of the cutting in order to reduce the effect on the setting. The cutting will remove part of the former gardens, although a retaining wall will be constructed in order to reduce the amount of land required for the cutting. Extensive views across lower ground to the south are likely to be curtailed by noise barriers, security fencing and planting. This will constitute a high adverse impact and major adverse significant effect.

7.4.46 The Triumphal Arch, Shugborough Park (COY036), an asset of high value, will be subject to a permanent change in its setting. Given its elevation above the floodplain, the Arch provides perhaps the best viewpoint for an appreciation of Shugborough's landscape. It was constructed in the later 18th century as part of a larger landscape design conception within which it, and other ornamental buildings in Shugborough Park, were intended to form the focus of both inward and outward views. The views from many of the ornamental buildings within the park are limited in extent by their location on the floodplain. By contrast, the elevated location of the arch on the slopes running down from Cannock Chase provide it with relatively clear and long-distance views extending beyond the limits of the park. Taking these factors into account, the views looking out from the arch to the north across the parkland and beyond form an essential part of its heritage significance. The northward views take in Shugborough Park Farm, Shugborough Hall and the wooded Trent Valley beyond. Once constructed, the Great Haywood viaduct and the embankments to either side will be visible, partly masked by trees, crossing the valley beyond the main house at a distance of greater than 2km (as illustrated on the photomontage shown in Figure LV-01-526 in Volume 5: Appendix LV-001-002). Planting will be undertaken on the Trent South embankment to reduce effects on setting. Given the landscape function of the Arch and the importance of its outwards views in appreciating the park and house in its setting, this change will represent a low adverse impact and a moderate adverse significant effect.

7.4.47 The Trent and Mersey Canal Conservation Area (COY037), an asset of moderate value, will be subject to a permanent change in its setting. The most significant elements of the setting of the canal in this section of the Trent Valley lie in its relationship to the surrounding largely rural river valley landscape, as well as the roads and river that run parallel to it. The Great Haywood viaduct will be prominent in views along the canal and in views across the Conservation Area's rural setting. This will constitute a medium adverse impact and a moderate adverse significant effect.

7.4.48 Ingestre Conservation Area (COY049), an asset of moderate value, will be subject to a permanent change in its setting. The Conservation Area has relatively few significant outward or inward views, with the core of the estate being largely masked by trees. The most important relationships in terms of heritage significance tend to be those between the various key elements of the estate: the buildings, landscape features and

gardens. The south-western end of Lionlodge Covert will be removed by the Trent North embankment. This will pass immediately south of the tree-lined carriageway that leads from Ingestre House to the Lion Lodges, which lie within the Conservation Area. The route of the Proposed Scheme, together with overhead line equipment, noise barriers, security fencing and mitigation planting will be in full view from the asset at these locations. The Tixall Bridleway 0.1628 accommodation overbridge will also be visible. The route will run between the historic parklands of Ingestre and Tixall that were formerly set out partially in relation to one another, albeit both parks were substantially degraded during the 20th century. However, the core area around Ingestre Hall, St Mary's Church and the stables will remain largely unaffected, as only limited, distant views of the Proposed Scheme will be apparent and change in noise will be insignificant. Taken together, these changes will constitute a medium adverse impact and a moderate adverse significant effect.

7.4.49 Lowerhouse Farm, Hopton (COY100), an asset of low value, will be subject to a permanent change in its setting. The farm's location at the foot of the high ground upon which Hopton village stands means that it has important views looking across the farmed landscape to the south. A landscape bund north of the Hopton embankment, located approximately 70m to the south of the farmhouse and 10m from farmyard buildings, will block views across the fields towards Beacon Hill, which will adversely affect the significance of the farm and its historic relationship with adjacent farmland. This will constitute a high adverse impact and a moderate adverse significant effect.

7.4.50 There will be a permanent change in the heritage significance of the historic landscape at:

- HLCA 7 Trent Valley and Weston to the north of Great Haywood, already contains extensive industrial transport infrastructure, including significant canal, railway and road routes. Notwithstanding this, the construction of the Trent South embankment and Great Haywood viaduct running across this landscape, perpendicular to the existing valley infrastructure will result in a medium adverse impact. Given that this HLCA is an area of moderate value, this will result in an overall moderate adverse significant effect; and
- HLCA 8 Ingestre and Tixall will experience a permanent effect on its historic landscape as a result of the Proposed Scheme. The Trent North embankment and Brancote South cutting will run across portions of both parks, cutting obliquely through the historic boundary between them. The magnitude of impact, taking into account design mitigation including the Ingestre green overbridge, is considered to be medium adverse. Given that the HLCA is an area of moderate value, this will result in an overall moderate adverse significant effect; and
- HLCA 10 Marston and Yarlet will experience a permanent effect on its historic landscape as a result of the Proposed Scheme. The Marston South cutting will run across the northern part of Marston DMV, while the Yarlet South cutting will remove a substantial part of the historic landscape features on Yarlet Hill. The magnitude of impact is considered to be medium adverse. As the HLCA is

an area of moderate value, this will result in an overall moderate adverse significant effect.

Other mitigation measures

7.4.51 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme or included in the draft CoCP will be considered during detailed design to reduce further the significant effects described above. These refinements will include the identification of:

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

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

Summary of likely residual significant effects

7.4.53 The temporary effects of construction activity on the setting of heritage assets have been considered. However, they are largely reversible in nature and will be restricted to the duration of the construction works.

7.4.54 As no mitigation beyond that described above has been identified the residual effects are the same as those reportedunder permanent effects.

Cumulative effects

7.4.55 No cumulative effects on heritage assets during construction have been identified in the Colwich to Yarlet area.

7.5 Effects arising from operation

Avoidance and mitigation measures

7.5.1 The following measures have been incorporated into the design of the Proposed Scheme which will reduce the impacts and effects on heritage assets, as shown on the CT-06 Map Series within the Volume 2: CA2 Map Book:

- tree planting to the north of Moreton Grange (COY004) and to the south of Moreton House (COY006) which will reduce the visual effects on setting from the operation of trains;
- noise fence barriers on the Trent South embankment which will reduce noise effects on the settings of the Great Haywood and Shugborough Conservation Area (COY041) and Shugborough Park Grade I registered park and garden (COY034);
- noise fence barriers on the Great Haywood viaduct which will reduce noise effects on the settings of Great Haywood and Shugborough Conservation Area

(COY041), Trent and Mersey Canal Conservation Area (COY037) and Staffordshire and Worcestershire Canal Conservation Area (COY040);

- noise fence barriers on the Trent North embankment and Brancote South cutting which will reduce noise effects on the setting of the Ingestre Conservation Area (COY049); and
- landscape planting which will increasingly reduce impacts on the setting of the assets within the area as it matures.

Assessment of impacts and effects

7.5.2 The assessment considers the Proposed Scheme once operational and all effects are considered to be permanent. There will be no physical impacts on buried archaeological remains or other heritage assets arising from the operation of the Proposed Scheme. Impacts on heritage assets due to changes in their settings arising from the physical presence of the Proposed Scheme are described as permanent occurring within the construction phase and are not repeated in detail here, although they will occur through the operation of the Proposed Scheme. Where there is a combined effect on the setting of an asset from the presence of the constructed scheme and its operation, this is reported in the assessment of operation.

7.5.3 Significant effects will occur as a result of permanent changes to the setting of the following assets arising from the impacts of railway operation.

7.5.4 Moreton Grange (COY004), an asset of low value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. This historic farm currently sits in a quiet rural environment, with significant elements of its setting including its relationships with Moreton Farm and Moreton House to the north. This will be affected by noise from, and visibility of, passing trains along Moreton North embankment, approximately 75m to the north. In combination with the permanent effects of the Proposed Scheme the effect will remain as moderate adverse significant.

7.5.5 Moreton House (COY006), an asset of moderate value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. Its historic significance as a country house, set within a designed garden within a quiet rural landscape, is an important aspect of it setting. Trains running on Morton North embankment and in Moreton cutting will introduce noise and visual impacts and alter the setting of the building. In combination with the permanent effects of the Proposed Scheme the effect will remains as major adverse significant.

7.5.6 The Trent and Mersey Canal Conservation Area (COY037), an asset of moderate value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. The historic character of the canal, with slow-moving barges stopping frequently to pass through locks, contrasts with the nature of a high-speed railway. Trains running on the Great Haywood viaduct will be prominent in views along the canal and in views across the Conservation Area's rural setting. However, the effects will be experienced intermittently over a relatively short section of the canal. In combination with the permanent effects of the Proposed Scheme the effect will remain as moderate adverse significant.

7.5.7 The Triumphal Arch, Shugborough Park (COY036), an asset of high value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. This is the consequence of the introduction of the Great Haywood viaduct, albeit at a distance of over 2km, into its designed northward views across Shugborough Park and the Trent Valley beyond. The regular movement of trains across the viaduct will add to this effect of its presence in the landscape. In combination with the permanent effects of the Proposed Scheme the effect will remain as moderate adverse significant.

7.5.8 Trains running on the Trent North embankment will run across the landscape between the Ingestre Conservation Area (COY049), an asset of moderate value, and the Trent Valley beyond. The heritage significance of the Conservation Area lies predominantly in the relationships between the different historic elements within it: the village, the historic estate buildings and the remnant designed landscape. The changes will affect the historic parkland character of the Conservation Area, in outward and inward views, albeit there are already numerous other modern elements of transport infrastructure in this landscape. In combination with the permanent effects of the Proposed Scheme the effect will remain as moderate adverse significant

7.5.9 Lowerhouse Farm, Hopton (COY100), an asset of low value, will be subject to a permanent change in its setting as a result of the operation of the Proposed Scheme. An important aspect of its setting comprises views across the open landscape to the south. This will be changed as a result of the noise of the passing trains running on the route of the Proposed Scheme, immediately to the south. In combination with the permanent effects of the Proposed Scheme the effect will remain as moderate adverse significant.

7.5.10 No significant effects on HLCAs will result from the operation of the Proposed Scheme in the Colwich to Yarlet area.

Other mitigation measures

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

Summary of likely residual significant effects

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

Cumulative effects

7.5.13 No cumulative effects on heritage assets during operation have been identified in the Colwich to Yarlet area.

Monitoring

7.5.14 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

7.5.15 There are no area-specific heritage monitoring requirements during operation of the Proposed Scheme. It is assumed that all heritage assets within the land required for the Proposed Scheme will be removed during construction unless expressly excluded as a result of the mitigation process.

7.5.16 Where there are likely residual significant effects at Moreton Grange, Moreton House and Lowerhouse Farm the specific operational monitoring requirements in relation to noise effects, are described in Section 13, Sound, noise and vibration.

8 Ecology and biodiversity

8.1 Introduction

8.1.1 This section of the report describes the ecological baseline and identifies likely impacts and significant ecological effects that will arise from the construction and operation of the Proposed Scheme in the Colwich to Yarlet area. This includes effects upon sites recognised or designated on the basis of their importance for nature conservation.

8.1.2 Engagement has been undertaken with national organisations and regional and local stakeholders including: Natural England; Environment Agency; Forestry Commission; Staffordshire Wildlife Trust; Royal Society for the Protection of Birds (RSPB); Woodland Trust; and Staffordshire County Council (SCC). The purpose of this engagement has been to obtain relevant baseline information and inform the design development and assessment of the Proposed Scheme.

8.1.3 Volume 5 contains supporting information to the ecological assessment reported in this section, including:

- ecological baseline data - designated sites (see Volume 5: Appendix EC-001-000);
- an ecology register of local level effects, which are not reported individually in Volume 2 (Volume 5: Appendix EC-016-002);
- a Habitats Regulations Assessment screening report and addendum for Pasturefields Salt Marsh Special Area of Conservation (Volume 5: Appendix EC-017-003 and EC-017-004); and
- Habitats Regulations Assessment screening report for the Chartley Moss Site of Special Scientific Interest element of the Midland Meres and Mosses Phase 1 Ramsar site and the West Midland Mosses Special Area of Conservation (Volume 5: Appendix EC-017-005).

8.1.4 Map Series EC-01 showing statutory and non-statutory designated sites of relevance to the assessment in the Colwich to Yarlet area is provided in the Volume 5: Ecology Map Book.

8.1.5 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

8.1.6 In addition, ecological baseline data relating to habitats and species recorded in the Colwich to Yarlet area is set out in Background Information and Data (BID)[87] (BID-EC-002-000 to BID-EC-014-000) and accompanying Map Series EC-02 to EC-12 (BID Ecology Map Books).

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

8.2 Scope, assumptions and limitations

8.2.1 The scope, assumptions and limitations for the ecological assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)[88] and the SMR Addendum[89].

8.2.2 A route-wide Water Framework Directive (WFD) compliance assessment has been undertaken in conjunction with the environmental assessment (Section 15, Water resources and flood risk). Details of the assessment are presented in Volume 5: Appendix WR-001-000.

8.2.3 Access was obtained to the majority of land where general habitat survey (Phase 1 habitat survey) was proposed. However, access could not be gained in time for seasonally constrained surveys at a few locations that have potential to support key ecological features. These include Lionlodge Covert Local Wildlife Site (LWS). Further details are provided in Background Information and Data: BID-EC-002-000 to BID-EC-014-000.

8.2.4 Where data are limited, such as due to the absence of field surveys, a precautionary baseline has been built up according to the guidance reported in the SMR and the SMR Addendum. This constitutes a 'reasonable worst case' basis for the subsequent assessment and development of mitigation. Background Information and Data: BID-EC-002-000 to BID-EC-014-000 identifies these survey locations. Where the assessment has been based upon limited data, the ecological receptor is described as 'of up to' a specific value.

8.2.5 The precautionary approach to the assessment that has been adopted identifies the likely significant ecological effects of the Proposed Scheme. Unless otherwise stated, the description of effects assumes that land within the Bill limits will be subject to habitat loss resulting from development of the Proposed Scheme, with the land required for construction purposes only being reinstated following completion of construction. With respect to overhead line diversions/realignments in particular, it is likely that the majority of the habitats within the land required for the Proposed Scheme can in fact be retained, and land is only required to allow for raising or lowering of pylons and/or re-stringing of cables, or to provide an access route to the works.

8.3 Environmental baseline

Existing baseline

8.3.1 This section describes the ecological baseline relevant to the assessment: the designated sites, habitats and species recorded in this area. Further details are provided in the reports presented in Volume 5: Appendix EC-001-000 and Background Information and Data: BID-EC-002-000 to BID-EC-015-000, and maps presented in Volume 5: Map Series EC-01 and BID Ecology Map Books: Map Series EC-02 to EC-12. Statutory and non-statutory designated sites are shown on Volume 5: Map EC-01-305b to EC-01-309a.

[88] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[89] Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

8.3.2 Land required for and adjacent to the Proposed Scheme in the Colwich to Yarlet area consists mainly of intensively managed agricultural land that is interspersed with woods, farmsteads and residential settlements. There are meadows alongside Moreton Brook (to the south-east of Moreton), several low hills (to the north-east of Little Haywood), the River Trent floodplain (to the west of Great Haywood) and predominantly higher ground between Ingestre and Yarlet.

Designated sites

8.3.3 There are three internationally important sites of potential relevance to the assessment in the Colwich to Yarlet area. These are:

- Cannock Chase Special Area of Conservation (SAC), covering an area of approximately 1,240ha, is designated for its European dry heath[90] (which is an Annex 1 habitat). The Cannock Chase SAC is the most extensive area of lowland heathland in the Midlands and is characterised by heather, western gorse and wavy hair-grass. Cowberry, crowberry and intermediate bilberry, which are typical of northern heathlands, are also present. This SAC is located to the south of Ingestre, approximately 2.6km south of the route of the Proposed Scheme and approximately 830m south-west of a construction traffic route along the A51 Lichfield Road;
- Chartley Moss Site of Special Scientific Interest (SSSI) and National Nature Reserve (NNR), covering an area of approximately 105.8ha, is a component of the West Midlands Mosses SAC and Midland Meres and Mosses Phase 1 Ramsar site. The SSSI is designated for its natural dystrophic open water and quaking peat bog (which is an Annex 1 habitat). Chartley Moss SSSI is located to the north-east of Great Haywood, approximately 4.3km north of the route of the Proposed Scheme and approximately 170m south of a construction traffic route along the A518 Uttoxeter Road; and
- Pasturefields Salt Marsh SAC, covering an area of approximately 7.7ha, is designated for its inland salt meadow (which is an Annex 1 priority habitat). The Pasturefields Salt Marsh SAC is cited as the best example in the UK of a natural salt spring and inland salt meadow, and is characterised by red fescue, with saltmarsh rush, sea plantain, common saltmarsh-grass, lesser sea-spurrey and sea arrowgrass. This SAC is located to the east of Ingestre, approximately 870m north of the route of the Proposed Scheme and approximately 60m west of a construction traffic route along the A51 Lichfield Road.

8.3.4 There are eight nationally important SSSIs (including one site which is also a National Nature Reserve (NNR)) of potential relevance to the assessment in the Colwich to Yarlet area. The land required for the Proposed Scheme is located within the Natural England Impact Risk Zones[91] for these SSSI. They are:

[90] Annex 1 of the EU's Habitats Directive (1992) lists key habitat types whose conservation requires the designation of Special Areas of Conservation.

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

- Blithfield Reservoir SSSI, covering an area of approximately 436.9ha, is designated because it regularly supports >1% of the national wintering population of goosander. This SSSI is located north of Stockwell Heath approximately 730m north-west of the land required for the Proposed Scheme within the Fradley to Colton area (CA1). The land required for the Proposed Scheme at Moreton Brook, east of Moreton Farm is within the Natural England Impact Risk Zone for this site;
- Stafford Brook SSSI, covering an area of approximately 7.2ha, is designated for its purple moor-grass marshy grassland, which is a nationally rare habitat in lowland England. This SSSI is located south of Moreton Grange, approximately 2.9km south of the land required for the Proposed Scheme;
- Cannock Chase SSSI, covering the same area as Cannock Chase SAC (1,240ha), is designated for its diverse semi-natural vegetation, which comprises nationally important ancient woodland, lowland heathland and wet heathland. This SSSI is located to the south of Ingestre, approximately 2.6km south of the land required for the Proposed Scheme and approximately 830m south-west of a construction traffic route along the A51 Lichfield Road;
- Chartley Moss SSSI and NNR, covering an area of approximately 105.8ha, is part of the West Midlands Mosses SAC and Ramsar site. This SSSI is designated for its quaking and transitional peat bog habitats. The peat bog is characterised by bog mosses and is of importance for invertebrates, which include the white-faced darter dragonfly. The SSSI also supports valuable wet woodland and is of importance for marsh fern. This SSSI is located to the north-east of Great Haywood, approximately 4.3km north of the land required for the Proposed Scheme and approximately 170m south of a construction traffic route along the A518 Uttoxeter Road;
- Pasturefields Salt Marsh SSSI, covering the same area as Pasturefields Salt Marsh SAC (7.7ha), is designated for its inland salt meadow and notable breeding populations of snipe, redshank and lapwing. This SSSI is located east of Ingestre, approximately 870m north of the land required for the Proposed Scheme and approximately 60m west of a construction traffic route along the A51 Lichfield Road;
- Rawbones Meadow SSSI, covering an area of approximately 20ha, is designated for its wetland habitats, which support a notable breeding population of snipe. This SSSI is located south of Tixall Farm, approximately 800m south of the land required for the Proposed Scheme;
- Baswich Meadows SSSI, covering an area of approximately 13ha, is designated for its wetland habitats, which support notable breeding populations of redshank, snipe and lapwing. The SSSI is located south-west of Upper Hanyards, approximately 2.2km south-west of the land required for the Proposed Scheme; and
- Doxey and Tillington Marshes SSSI, covering an area of 123.9ha, is designated for its wetland habitats, which support notable breeding populations of snipe, redshank and lapwing. The SSSI is located south-west of Marston,

approximately 3.1km south-west of the land required for the Proposed Scheme.

8.3.5 There are four Local Wildlife Sites (LWSs) of potential relevance to the assessment in the Colwich to Yarlet area, each of which is of county value. They are:

- Lount Farm LWS, covering an area of approximately 14.2ha, is designated for its marshy grassland. The LWS is located partially within the land required for the Proposed Scheme. Lount Farm LWS is located partially within the Colwich to Yarlet area to the east of Moreton Grange. The remainder of the LWS is in the Fradley to Colton area (CA1);
- Tixall Broad Water LWS, covering an area of approximately 10.3ha, is designated for the wide stretch of canal south-west of Tixall Lock to Haywood Junction, which supports a diverse marginal flora and includes locally uncommon species such as sweet flag, common reed and greater tussock-sedge. This LWS is located approximately 120m south of the land required for the Proposed Scheme, to the south of Tixall Farm;
- Hopton Pools (north of) LWS, covering an area of approximately 0.3ha, is designated for a meadow that supports a colony of heath spotted-orchid. This LWS is located approximately 200m north of the land required for the Proposed Scheme, to the south-east of Hopton; and
- Lionlodge Covert LWS, covering an area of approximately 16.9ha, is designated for its broadleaved semi-natural woodland with a salt spring pool and an inland salt meadow supported by springs from historic salt mining. The salt meadow habitat supports two typical saltmarsh plants, saltmarsh rush and stiff saltmarsh-grass (which is nationally scarce). This LWS is located partially within the land required for the Proposed Scheme, south-east of Ingestre.

8.3.6 There are three Biodiversity Alert Sites (BASs) of potential relevance to the assessment in the Colwich to Yarlet area, each of which is of district/borough value. They are:

- Bishton (north of) BAS is designated for native species-rich hedgerows on both sides of Bishton Lane. This linear BAS extends for approximately 2km and is located within the land required for the Proposed Scheme, between Bishton Lane Farm and Moreton Grange;
- Tixall Park Pool BAS, covering an area of approximately 4.2ha, is designated for its large pool and marginal vegetation. This BAS is located immediately adjacent to the land required for the Proposed Scheme, south-west of Ingestre; and
- New Plantation BAS, covering an area of approximately 3.2ha, is designated for broadleaved plantation woodland and a pond. This BAS is located immediately adjacent to the land required for the Proposed Scheme, north-west of Yarlet.

8.3.7 There is one Ancient Woodland Inventory (AWI) site of potential relevance to the assessment in the Colwich to Yarlet area, which is of up to county value. Lambert's

Coppice AWI site, covering an area of approximately 14.1ha, is located immediately adjacent to land required for the Proposed Scheme, north-west of Ingestre.

8.3.8 On the basis of the heritage review undertaken by HS2 Ltd, Natural England has confirmed that five woodlands of potential relevance to the assessment in the Colwich to Yarlet area will be added to the AWI, each of which are of up to county value. These are:

- Tithebarn Covert, covering an area of approximately 5.1ha, is located immediately adjacent to the land required for the Proposed Scheme at Tithebarn Farm[92], east of Great Haywood;
- Ingestre Wood, covering an area of approximately 9.4ha, is located immediately adjacent to the land required for the Proposed Scheme for woodland habitat creation, south-west of Ingestre;
- Flushing Covert, covering an area of approximately 1.2ha, is partially located within the land required for the Proposed Scheme, south of Ingestre;
- Town Field Plantation, covering an area of approximately 0.4ha, is partially located within the land required for the Proposed Scheme at Ingestre Park Golf Club; and
- The Grove, covering an area of approximately 1.7ha, is located partially within the land required for the Proposed Scheme at Yarlet Hill, north-east of Yarlet.

Habitats

8.3.9 The following habitat types which occur in the Colwich to Yarlet area are relevant to the assessment.

Woodland

8.3.10 Lambert's Coppice is listed on the AWI and is a plantation on an ancient woodland site (PAWS). The woodland at Lambert's Coppice is likely to qualify as lowland mixed deciduous woodland, a habitat of principal importance in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006[93]) and a conservation priority of the Staffordshire Biodiversity Action Plan[94] (local BAP). The 14.1ha woodland is located immediately adjacent to land required for the Proposed Scheme. The woodland habitat is of up to county value.

8.3.11 The five woodlands to be added to the AWI are likely to qualify as lowland mixed deciduous woodland, a habitat of principal importance and a conservation priority of the local BAP. The woodland habitat within each of these five sites is of up to county value.

8.3.12 There are 14 other woodlands that qualify or are likely to qualify as lowland mixed deciduous woodland, a habitat of principal importance. These are:

[92] This is also shown on OS mapping as Tithe Barn Farm.
[93] Natural Environment and Rural Communities Act 2006 (2006 CHAPTER 16). Her Majesty's Stationery Office, London.
[94] Staffordshire Biodiversity Partnership. *Staffordshire Biodiversity Action Plan* [online]. Available at: http://www.sbap.org.uk/

- Lionlodge Covert LWS, of which approximately 15.4ha of the total 16.9ha area is woodland, is located partially within the land required for the Proposed Scheme, south-east of Ingestre. The woodland habitat is of up to county value;
- New Plantation BAS, covering an area of approximately 3.2ha, is located immediately adjacent to the land required for the Proposed Scheme, north-west of Yarlet. The woodland habitat is of up to district/borough value;
- Jewstrump Covert, covering an area of approximately 2.7ha, is located immediately adjacent to the land required for the Proposed Scheme at Tithebarn Farm, east of Great Haywood. The woodland habitat is of up to district/borough value;
- Ford's Belt is a woodland to the north-west of Tixall Park Pool, covering an area of approximately 2.6ha, is located immediately adjacent to the land required for the Proposed Scheme, south of Upper Hanyards. The woodland habitat is of up to district/borough value;
- a woodland belt, which includes some veteran[95] trees, covering an area of approximately 3ha, is located partially within the land required for the Proposed Scheme, on the west side of Ingestre Park Golf Club. This woodland connects with Ingestre Wood. The woodland habitat is of up to district/ borough value;
- Lower Berryhill Wood, covering an area of approximately 4.3ha, is partially located within the land required for the Proposed Scheme, south-west of Park Farm and south of the Staffordshire County Showground. The woodland habitat is of up to district/borough value;
- an un-named wood, covering an area of approximately 1.3ha, is immediately adjacent to the land required for the Proposed Scheme, west of Upper Hanyards. The woodland habitat is small in extent and of up to local/parish value; and
- a further seven woodlands (each <1.5ha and none within wildlife site designations) at the following locations: north of Upper Hanyards; Upper Berryhill; three at Hopton; Yarlet School; and Yarlet Wood. These woodland habitats are of up to local/parish value.

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

- an area of woodland, covering an area of approximately 0.8ha, has a canopy dominated by pedunculate oak with frequent ash. The understorey contains elder, hawthorn and field maple. The field layer is dominated by bramble and common nettle. The species composition of this habitat is characteristic of the National Vegetation Classification (NVC[96]) W8e *Fraxinus excelsior-Acer*

[95] Veteran trees are younger than ancient trees, but have features found on ancient trees such as decay in the trunk, branches and/or roots. Veteran trees are included on the Ancient Tree Inventory.
[96] NVC is a detailed survey and classification system that is used to compare plant communities within a range of defined community types.

campestre-Mercurialis perennis woodland *Geranium robertianum* sub-community. This woodland is partially located within the land required for the Proposed Scheme, on the north-west side of Tithebarn Farm. The woodland habitat is small in extent and of local/parish value;

- Little Covert, covering an area of approximately 1.1ha, is predominantly broadleaved woodland although approximately 10% has been planted with European larch. The canopy comprises ash, pedunculate oak, wych elm and sycamore. The understorey contains elder and hawthorn. The field layer is dominated by bramble and common nettle is frequent. The species composition of this habitat is characteristic of NVC W8e *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland *Geranium robertianum* sub-community. This woodland is partially located within the land required for the Proposed Scheme at Tithebarn Farm, north-east of Great Haywood. The woodland habitat is small in extent and of local/parish value; and
- an area of unnamed plantation belt, covering an area of approximatley 0.3ha, is located adjacent to the Trent and Mersey Canal and River Trent, to the north of Great Haywood Marina. The canopy is dominated by ash with frequent wych elm, Canadian poplar and pedunculate oak. The understorey contains hawthorn, wych elm and elder. The field layer is dominated by false oat-grass with frequent hogweed and red campium.This woodland is partially located within the land required for the Proposed Scheme. The woodland habitat is small in extent and of local/parish value.

Grassland

8.3.14 Marshy grassland, covering an area of approximately 18.2ha occurs alongside the Moreton Brook partially within land required for the Proposed Scheme. In total 6.9ha of marshy grassland is located within Lount Farm LWS. The remainder of the marshy grassland within the Lount Farm LWS is located within the Fradley to Colton area (CA1) partially within land required for the Proposed Scheme. In addition, 4ha of marshy grassland is located outside Lount Farm LWS in this area within the land required for the Proposed Scheme. The species-rich marshy grassland is characteristic of NVC MG4 Alopecurus pratensis-Sanguisorba officinalis grassland. MG4 grassland is lowland meadow, a habitat of principal importance and a conservation priority of the local BAP. This lowland meadow is partially located within the land required for the Proposed Scheme. Species-rich MG4 grassland is uncommon and this habitat is of county value.

8.3.15 Marshy grassland, covering an area of approximately 2.1ha, occurs on the south side of Tolldish Lane adjacent to a minor tributary of the River Trent, north-east of Great Haywood. The grassland is representative of lowland meadow, a habitat of principal importance and a conservation priority of the local BAP. This lowland meadow is partially located within the land required for the Proposed Scheme. The grassland habitat is of up to county value.

8.3.16 An extensive area of mainly improved and species-poor semi-improved grassland, covering an area of approximately 67.5ha, occurs on the River Trent floodplain near Great Haywood. This grassland is subject to periodic inundation from the River Trent and thus qualifies as floodplain grazing marsh, a habitat of principal importance and a

conservation priority of the local BAP. This grassland is located within the land required for the Proposed Scheme. The grassland habitat is of up to district/borough value.

8.3.17 Species-poor semi-improved grassland covers an area of approximately 23.6ha throughout the Colwich to Yarlet area within the land required for the Proposed Scheme. Areas of species-poor semi-improved grassland are of local/parish value.

Hedgerows

8.3.18 There are approximately 2km of hedgerow in the Bishton (north of) BAS, which is designated for native species-rich hedgerows on both sides of Bishton Lane, that is located within the land required for the Proposed Scheme. This site is primarily designated for its species diversity and value of the structure of the hedgerow. This BAS is of district/borough value.

8.3.19 In total, there are approximately 33.9km of hedgerow within the land required for the Proposed Scheme in the Colwich to Yarlet area. Hedgerow with at least 80% cover of native woody species is a habitat of principal importance. Hedgerows within the land required for the Proposed Scheme comprise approximately:

- 10.3km of native species-poor; and
- 23.6km of native species-rich; of which 1.4km are also classified as 'Important' according to the 'Wildlife and Landscape' criteria described in The Hedgerows Regulations 1997[97].

8.3.20 Of the 33.9km of hedgerow a total of 17.7km of hedgerows have not been subject to survey. To accord with Phase 1 habitat descriptions these hedgerows are mapped as native species-rich on Map Series EC-02 (in the BID Ecology Map Books) and they are included as native species-rich in the list above. This is highly precautionary and, based on ratios from the surveyed hedgerows in this area, it is likely that part of the un-surveyed hedgerow network will be species-poor.

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

Watercourses

8.3.22 Moreton Brook and its associated tributaries, the Trent and Mersey Canal, the River Trent, two unnamed tributaries of the Kingston Brook, and several smaller watercourses will be crossed by the route of the Proposed Scheme. Moreton Brook, the Trent and Mersey Canal, the River Trent and Kingston Brook may qualify as habitats of principal importance and local BAP habitats. These watercourses and adjacent habitats are intrinsically important and provide corridors for wildlife dispersal, as such they are considered to be of up to county value. The smaller watercourses are of up to district/borough value.

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

Water bodies

8.3.23 There are 40 ponds located within, or partially within, the land required for the Proposed Scheme, and a further 93 ponds within 250m of the land required for the Proposed Scheme in the Colwich to Yarlet area. On a precautionary basis it is assumed that all ponds are habitats of principal importance or local BAP habitats and are of up to district/borough value unless surveys have shown that they are of local/parish value only.

Saltmarsh

8.3.24 Inland salt meadow (a type of saltmarsh), covering an area of approximately 7.7ha, occurs at Pasturefields Salt Marsh SAC and SSSI, which supports saltmarsh rush, sea plantain, common saltmarsh-grass, lesser sea-spurrey and sea arrowgrass. Inland salt meadow is an Annex 1 priority habitat[98]. The inland salt meadow at Pasturefields Salt Marsh SAC and SSSI is of up to international value and is located to the east of Ingestre, approximately 60m west of a construction traffic route along the A51 Lichfield Road.

8.3.25 Inland salt meadow, covering an area of approximately 1.5ha, also occurs at Lionlodge Covert LWS. The salt meadow comprises marshy grassland and is characteristic of NVC community MG10b *Holco-Juncetum effusi* rush pasture *Juncus inflexus* sub-community. The salt meadow is dominated by creeping bent with occasional soft-rush and several patches of saltmarsh rush. Stiff saltmarsh-grass (which is nationally scarce) was recorded within the salt meadow by the Staffordshire Wildlife Trust during June 2014. The salt meadow is located within the land required for the Proposed Scheme. As a consequence of agricultural management the salt meadow is of county value.

Ancient and veteran trees

8.3.26 Ancient[99] and veteran trees with potential relevance to the assessment in the Colwich to Yarlet area have been considered.

8.3.27 There is one tree recorded on the ancient tree inventory within the land required for the Proposed Scheme. A veteran oak (Tree 113476[100]) is located in a field on the north-west side of The Grove at Yarlet Hill. This tree is of district/borough value.

8.3.28 On the basis of the surveys undertaken there are seven trees within the land required for the Proposed Scheme that are considered to be of a sufficient age and/or support features to indicate they are of veteran status. Each of the trees is considered to be of up to district/borough value. These are:

- a lime located on the south-west side of Ingestre Park Golf Club;

[98] Joint Nature Conservation Committee, Annex 1 habitats occurring in the UK. Available online at: http://jncc.defra.gov.uk/ProtectedSites/SACselection/SAC_habitats.asp

[99] An ancient tree is one that has passed maturity and is old, or aged, in comparison with other trees of the same species. Ancient trees are included on the Ancient Tree Inventory.

[100] The Woodland Trust. Available online at: http://maps.woodlandtrust.org.uk/en/_layouts/woodlandtrust/FullScreenMap.aspx?mode=Wood&wood=&zoom=12&clat=52.743775&clon=-1.922951&ms=s&layers=10995116278O8&LegendGroups=ATH

- a horse-chestnut located on the south-west side of Ingestre Park Golf Club;
- an ash located south of Hopton Lane and west of Spode Avenue in Hopton;
- a horse-chestnut located south of Lowerhouse Farm, Hopton within a small woodland; and
- three beech trees located south of Yarlet Bank Farm.

Protected and notable species

8.3.29 A summary of the likely value of protected and/or notable species of relevance to the assessment is provided in Table 16.

Table 16: Protected and notable species within the Colwich to Yarlet area

Resource/feature	Value	Receptor	Baseline and rationale for valuation
Bats	Up to regional	Bat assemblage associated with habitats on the River Trent floodplain, south of Hoo Mill	Suitable bat foraging habitats are present on the River Trent floodplain, south of Hoo Mill, within the land required for the Proposed Scheme. Field surveys recorded high levels of activity (summer-autumn) and a diverse assemblage of bat species were recorded including common pipistrelle, soprano pipistrelle, Nathusius's pipistrelle, Myotid species, noctule and Leisler's bat. Roosts associated with this bat assemblage include a Daubenton's bat maternity roost at Shugborough Estate and a transitional/day roost for Natterer's bat at Tixall Farm noted from desk study records. The roosts are located approximately 800m and 500m from the land required for the Proposed Scheme respectively. Transitional/day roosts for small numbers of common and soprano pipistrelle, as well as a Myotid species, were also recorded in trees and buildings on the River Trent floodplain, south of Hoo Mill, within the land required for the Proposed Scheme. Leisler's bats are considered to be an uncommon species and Nathusis's pipistrelle are uncommon but widespread[101]. Noctule and soprano pipistrelle are both species of principal importance[102] and conservation priorities of the local BAP. Common pipsistrelle is a conservation prioritiy of the local BAP.
	Up to regional	Bat assemblage associated with habitat at Ingestre Park Golf Club	Suitable bat foraging habitats are present at Ingestre Park Golf Club within and adjacent to the land required for the Proposed Scheme. Field surveys recorded moderate levels of activity and a diverse assemblage of bat species were recorded for common pipistrelle, soprano pipistrelle, Nathusius' pipistrelle, Myotid species, brown long-eared bat and noctule. A maternity roost for a Myotid species and a mating site for common pipistrelle were also recorded in trees that are located within the land required for the Proposed Scheme. Brown long-eared bat is a species of principal importance. Myotid bats are all considered to be rarer species in England.

[101] Bat Conservation Trust (2014), *The State of the UK's bats: National Bat Monitoring Programme Population Trends 2014*. BCT, London.
[102] Natural England, (2010), Habitats and species of principal importance in England. Available online at: http://webarchive.nationalarchives.gov.uk/20140605090108/http:/www.naturalengland.org.uk/ourwork/conservation/biodiversity/protectandmanage/habsandspeciesimportance.aspx

Resource/feature	Value	Receptor	Baseline and rationale for valuation
	Up to regional	Bat assemblage associated with habitat at Upper Hanyards, west of Ingestre Park Golf Club	A large quantity of whiskered bat and brown long-eared bat droppings were recorded in a building at Upper Hanyards within the land required for the Proposed Scheme. The potential for a maternity colony of whiskered bats to be present, therefore, cannot be excluded. Whiskered bats are considered to be a rarer species in England[103].
	County	Bat assemblage associated with habitats near Moreton House	Field surveys recorded roosts in trees and buildings as well as the presence of foraging habitat near Moreton House within the land required for the Proposed Scheme. Small numbers of non-breeding roosts of a Myotid species, an unknown bat species and noctule were recorded.
	County	A single lesser horseshoe bat on the River Trent floodplain, south of Hoo Mill	A single pass of a lesser horseshoe bat was recorded during field surveys on the River Trent floodplain, south of Hoo Mill, within the land required for the Proposed Scheme. The lesser horseshoe bat was recorded during one evening in September 2016, which is when this species typically disperses up to 20km between their breeding and hibernation sites. Lesser horseshoe bat is an Annex 2[104] species, which is nationally scarce and a species of principal importance.
	County	Bat assemblage associated with habitat near Hopton	Field surveys recorded a transitional/day roost of noctule near Hopton Pools in a tree within the land required for the Proposed Scheme. Two transitional/day roosts of common pipistrelle and brown long-eared bat were also recorded in buildings near Hopton, within the land required for the Proposed Scheme.
	County	Bat assemblage associated with buildings at Park Farm, Upper Berryhill	Field surveys recorded roosts in buildings and trees near Upper Berryhill within the land required for the Proposed Scheme. The presence of a large quantity of brown long-eared bat droppings indicates that a maternity roost is present in one building. A small quantity of droppings of an unconfirmed bat species (which is likely to be a brown long-eared bat) was recorded in an adjacent building. Two transitional/day roosts of common pipistrelles were also recorded. One building supported a pipistrelle species (not thought to be Nathusius's).
	Local/parish	Bat assemblage associated with habitats near Moreton House	Field surveys recorded several transitional/day roosts of common and soprano pipistrelle in trees and buildings near Moreton House, within the land required for the Proposed Scheme.
	Local/parish	Bat assemblage associated with habitats at Marston	Field surveys recorded two transitional/day roosts of common pipistrelle and brown long-eared bat roosts in buildings at Marston, within the land required for the Proposed Scheme.
	Local/parish	Common pipistrelle population associated with habitats at Yarlet	Field surveys recorded three transitional/day roosts for common pipistrelle in two buildings and a tree at Yarlet, within the land required for the Proposed Scheme. Feeding remains found in one building also suggest brown long-eared bat presence.

[103] Wray, S. Wells, D. Long, E. & Mitchell-Jones, T. (2010). *Valuing Bats in Ecological Impact Assessment*, In-Practice,23-25. Chartered Institute of Ecology and Environmental Management, Winchester.
[104] Annex 2 of the EU's Habitats Directive (1992) lists priority species whose conservation requires the designation of Special Areas of Conservation.

Resource/feature	Value	Receptor	Baseline and rationale for valuation
Amphibians	County	A meta-population[105] (AMP2.1[106]) of great crested newt associated with 27 ponds that are centred on Moreton Farm (four of which are located within the Fradley to Colton area (CA1))	A meta-population of great crested newt was recorded during field surveys, which includes at least two small populations in three ponds. The ponds sit within a larger network of 27 ponds, which are located within and up to approximately 500m from the land required for the Proposed Scheme. Great crested newt is an Annex 2 species, a species of principal importance, and a conservation priority of the local BAP.
	County	A meta-population (AMP 2.2) of great crested newt associated with 12 ponds that are centred on Ingestre Park Golf Club	A meta-population of great crested newt was recorded during field surveys, which includes at least two medium and three small populations in five ponds. These ponds sit within a larger network of 12 ponds, which are located within and up to approximately 220m from the land required for the Proposed Scheme.
	County	A meta-population (AMP2.3) of great crested newt associated with 10 ponds centred on Hopton Lane	A meta-population of great crested newt was recorded during field surveys, which includes at least one small population in one pond. This pond also supports smooth newt and common frog. This pond is within the land required for the Proposed Scheme. This pond sits within a larger network of 10 ponds located between approximately 35m and 250m from the land required for the Proposed Scheme.
	Up to county	Populations of great crested newt within un-surveyed ponds within the Colwich to Yarlet area	Ponds that have not been surveyed are assumed to support breeding populations of great crested newt of medium size class.
	Local/parish	Populations of other amphibian species including palmate newt, smooth newt, common toad and common frog within the Colwich to Yarlet area	These common amphibian species have been identified within ponds throughout the Colwich to Yarlet area during field surveys and are assumed to be present within the ponds that have not yet been surveyed. Woodland, rough grassland and hedgerow habitats are likely to be used by these species during their terrestrial phase for foraging, dispersal and shelter. Each of these species is common and widespread throughout the UK. Common toad is a species of principal importance.
Birds	County	A pair of barn owl at upper Moreton Farm	There is a desk study record for a barn owl nest west of Upper Moreton Farm that regularly supports a pair of breeding barn owls. The barn owl nest box is located in the Colwich to Yarlet area approximately 150m from the boundary with the Fradley to Colton area (CA1). A barn owl from the nest site in the Fradley to Colton area (CA1) was recorded foraging over the land required for the Proposed Scheme near Moreton Grange during August 2016. Barn owl is a conservation priority of the local BAP.
	County	A pair of curlew at Tixall Farm	A pair of curlew regularly nest on the grassland to the south of Lionlodge Covert as confirmed by survey and desk study records. The curlew nest site is located within the land required for the Proposed Scheme. Curlew is a species of principal importance.

[105] A metapopulation is a group of spatially separated populations which interact. Metapopulations are described in BID-EC-007-000, Ecological baseline data - amphibian and pond surveys.
[106] The first and second number associated with the AMP reference relate to the specific CA and location e.g. AMP2.1 is within the Colwich to Yarlet area and is the first metapopulation encountered when following the route from London.

Resource/feature	Value	Receptor	Baseline and rationale for valuation
	District/borough	An assemblage of breeding bird species at Tithebarn Farm	Low densities of breeding birds, including two pairs of yellow wagtail, were recorded during field surveys at Tithebarn Farm within and adjacent to the land required for the Proposed Scheme. Based on these survey results, the Tithebarn farm survey site scores 10 on breeding bird assemblage for wet grassland (yellow wagtail, skylark and reed bunting) according to site selection criteria (Webb, 2014[107]). However, there is no wet grassland at this survey site and the aforementioned species were recorded nesting in arable crops. The breeding bird assemblage comprises nine species of principal importance and/or conservation priorities of the local BAP.
	Up to local/parish	Flocks of golden plover on the River Trent floodplain	Desk study records indicate the occurence of wintering flocks of golden plover throughout the Colwich to Yarlet area, particularly on the River Trent floodplain between Ingestre and Tixall, within and adjacent to the land required for the Proposed Scheme. At this location flocks of approximately 200 golden plovers are typical. Golden plover is an Annex 1[108] species.
	Up to local/parish	Flocks of lapwing on the River Trent floodplain	Desk study records indicate the occurence of wintering flocks of lapwing throughout the Colwich to Yarlet area, particularly on the River Trent floodplain between Ingestre and Tixall, within and adjacent to the land required for the Proposed Scheme. At this location flocks of approximately 200 lapwing are typical. A wintering flock of 127 lapwings was recorded during a survey on the River Trent floodplain between Ingestre and Rawbones Meadow, to the south-east of Tixall, within and adjacent to the land required for the Proposed Scheme. Lapwing is a species of principal importance and a conservation priority of the local BAP.
	Local/parish	An assemblage of wintering bird species at Tithebarn Farm	Low densities of common birds were recorded during field surveys at Tithebarn Farm within and adjacent to land required for the Proposed Scheme. The recorded wintering bird assemblage comprised five species of principal importance and/or conservation priorities of the local BAP.
	Local/parish	An assemblage of breeding bird species on the River Trent floodplain	Low densities of common birds were recorded during field surveys on the River Trent floodplain, north-west of Great Haywood, within and adjacent to the land required for the Proposed Scheme. The recorded breeding bird assemblage comprised five species of principal importance and/or conservation priorities of the local BAP.
	Local/parish	An assemblage of wintering bird species on the River Trent floodplain	Low densities of common birds were recorded during field surveys on the River Trent floodplain, north-west of Great Haywood, within and adjacent to the land required for the Proposed Scheme. The recorded wintering bird assemblage comprised five species of principal importance and/or conservation priorities of the local BAP.

[107] Webb, J., Lawley, S., Cadman, D., Slawson, C., Smith, J. and Weightman, J. (2014), Guidelines for the selection of sites of county biological importance in Staffordshire. Staffordshire Wildlife Trust, Stafford.
[108] Annex 1 of the EU's Wild Birds Directive (2009), lists species whose conservation requires the designation of Special Protection Areas

Resource/feature	Value	Receptor	Baseline and rationale for valuation
	Local/parish	An assemblage of breeding bird species at Upper Hanyards, west of Ingestre	Low densities of breeding birds were recorded during field surveys at Upper Hanyards, west of Ingestre, within and adjacent to the land required for the Proposed Scheme. The recorded breeding bird assemblage comprised two species of principal importance and/or conservation priorities of the local BAP.
	Local/parish	An assemblage of wintering bird species at Upper Hanyards, west of Ingestre	Low densities of common birds were recorded during winter survey visits at Upper Hayards, west of Ingestre, within and adjacent to the land required for the Proposed Scheme. The recorded wintering bird assemblage comprised six species of principal importance and conservation priorities of the local BAP.
Water vole	County	A small population of water vole near Moreton Brook	Field surveys recorded a water vole burrow and field survey signs along a ditch adjacent to Moreton Brook, immediately adjacent to the land required for the Proposed Scheme. Water vole is a species of principal importance and a conservation priority of the local BAP.
Vascular plants	Up to county	Galingale on the River Trent floodplain	A desk study record of galingale on the south side of Hoo Mill Bridge within the land required for the Proposed Scheme. A viable population recorded in August 2006 is considered to be extant. Galingale is listed as County Rare on the Staffordshire Flora Checklist 2017[109].
Otter	District/borough	A small population of otter near the River Trent and Trent and Mersey Canal	Otter occurs at low density throughout the Colwich to Yarlet area. Field survey signs of otter were recorded alongside the River Trent at Hoo Mill, during field surveys within the land required for the Proposed Scheme. Otter is an Annex 2 species, and is also a species of principal importance and a conservation priority of the local BAP.
Butterfly	District/borough	A small population of white-letter hairstreak butterfly to the south of Yarlet Bank Farm	Field surveys recorded three adult white-letter hairstreak butterflies to the south of Yarlet Bank Farm, within the land required for the Proposed Scheme. White-letter hairstreak butterfly is a species of principal importance.
Mollusc	Up to district/borough	A depressed river mussel from the River Trent at Bishton	A desk study record of a depressed river mussel from the River Trent at Bishton, approximately 700m from the land required for the Proposed Scheme. The depressed river mussel is a species of principal importance.
Fish	Up to district/borough	A diverse fish assemblage that has been recorded from the River Trent	Desk study records indicate the presence of a diverse fish assemblage in the River Trent near Great Haywood, downstream of the land required for the Proposed Scheme. Records for European eel, bullhead and spined loach were reported in the desk study. Bullhead and spined loach are Annex 2 species. European eel and spined loach are species of principal importance.
	Local/parish	Bullhead at Moreton Brook	Desk study records indicated a small population of bullhead at Moreton Brook within the land required for the Proposed Scheme.

A Checklist of the Flora of Staffordshire Revised 2017. Available online at http://bsbi.org/staffordshire.

Resource/feature	Value	Receptor	Baseline and rationale for valuation
			Bullhead is an Annex 2 species.
Badger	Local/parish	At least four social groups at undisclosed locations in the Colwich to Yarlet area	A common and widespread species recorded during field surveys in the Colwich to Yarlet area. Field surveys have identified at least four main setts within or adjacent to the land required for the the Proposed Scheme.
Fallow deer	Local/parish	Herds of fallow deer within the vicinity of Cannock Chase and Ingestre Park	A common and widespread species recorded during field surveys in the Colwich to Yarlet area.
Polecat	Local/parish	Potential populations using suitable habitats present in the Colwich to Yarlet area	There is a single desk study record of polecat reported from Pasturefields Salt Marsh SAC and SSSI approximately 60m west of a construction traffic route along the A518 Uttoxeter Road. Polecat is relatively widely distributed in Staffordshire. Polecat potentially occurs within the Colwich to Yarlet area, and is most likely to be present within networks of farmland with hedgerows and small woods. Polecat is a species of principal importance.
Harvest mouse	Up to local/parish	Potential populations using suitable habitats present in the Colwich to Yarlet area	Although no confirmed evidence of this species has been observed during field surveys, it is possible that populations of harvest mouse are present in hedgerows, arable land, areas of taller grassland and woodland edge habitats throughout the Colwich to Yarlet area. Harvest mouse is a species of principal importance.
European hedgehog	Up tp local/parish	Potential populations using suitable habitats present in the Cowich to Yarlet area	There are desk study records of European hedgehog within the Colwich to Yarlet area. This species is widely distributed throughout the UK and is likely to be present in suitable habitats throughout the Colwich to Yarlet area including woodland, hedgerows, grassland, scrub and gardens. European hedgehog is a species of principal importance.
Brown hare	Up to local/parish	Potential populations using suitable habitats present in the Colwich to Yarlet area	There are desk study records of brown hare from within the land required for the Proposed Scheme at Moreton, Tithebarn Farm, Tixall, Marston, and Yarlet. Brown hare is likely to be present in areas of open arable and grassland habitats throughout the Colwich to Yarlet area. Brown hare is a species of principal importance and a conservation priority of the local BAP.
Reptiles	Up to local/parish	Potential small populations of common reptiles (grass snake, slow-worm and common lizard) in the Colwich to Yarlet area	No reptiles were found during field surveys. Suitable habitat for reptiles that was not surveyed was generally constrained to field margins, edges of woodland and scrub habitat or isolated small patches of overgrown grassland. These habitats are within a generally intensively farmed landscape, offering limited opportunities for reptiles. It is, therefore, likely that any reptiles located within the land required for the Proposed Scheme are present in low numbers. Adder, grass snake, slow-worm and common lizard are all species of principal importance. Grass snake is also a conservation priority of the local BAP.
Hazel dormouse	Negligible	Potential populations using suitable woody habitats in the	No evidence has been found for the presence of hazel dormouse during field surveys that were conducted in four areas of suitable habitat (Tithebarn Covert, near Ingestre Park Golf Club, near Ingestre Wood and Lower Berryhill).

Resource/feature	Value	Receptor	Baseline and rationale for valuation
		Colwich to Yarlet area	There were no desk study records of hazel dormouse in the Colwich to Yarlet area. Whilst it was not possible to complete all surveys for hazel dormouse in Colwich to Yarlet area, given the lack of evidence and the fact no desk study records were reported, it is considered unlikely that any populations exist within the land required for the Proposed Scheme.
White-clawed crayfish	Negligible	Potential populations using watercourses in the Colwich to Yarlet area	No evidence was found for the presence of white-clawed crayfish during a survey that was conducted in suitable habitat of the River Trent near Great Haywood. There is a historical record of white-clawed crayfish from the Sher Brook (a tributary of the River Trent) upstream of Shugborough approximately 2km south from the land required for the Proposed Scheme. Due to the declining status of the white-clawed crayfish within Staffordshire, and the increasing prevalence of signal crayfish, it is assumed that white-clawed crayfish are absent from the Colwich to Yarlet area.

Future baseline

Construction (2020)

8.3.30 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2020.

8.3.31 No committed developments have been identified in this area that will materially alter the baseline conditions in 2020 for ecological receptors.

Operation (2027)

8.3.32 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2027.

8.3.33 No committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for ecological receptors.

8.4 Effects arising during construction

Avoidance and mitigation measures

8.4.1 The following measures have been included as part of the design of the Proposed Scheme (additional to the landscape planting as shown on the Map Series CT-06 along the route of the Proposed Scheme, which will be largely a mixture of woodland/scrub and grassland), and will contribute towards reducing effects on habitat and species:

- provision of the Great Haywood viaduct over the River Trent will avoid direct effects to this watercourse and allow free passage of wildlife beneath it; and
- refinement of the location of a balancing pond to avoid the loss of lowland meadow to a location further south of Moreton North embankment.

8.4.2 The assessment assumes implementation of the measures set out within the draft Code of Construction Practice[110] (CoCP) which includes sensitive construction practices and the preparation of habitat management plans.

8.4.3 Section 9 of the draft CoCP requires contractors to implement a range of measures to protect ecological receptors including the following:

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

Assessment of impacts and effects

8.4.4 Effects arising during construction that are significant at the district/ borough level or above are described below. Effects on ecological features of significance at the local/parish level are listed in Volume 5: Appendix EC-016-002.

Designated sites

8.4.5 Cannock Chase SAC and SSSI will not be affected by the construction of the Proposed Scheme. The closest point of the construction in this area will be the construction traffic using a route along the A51 Lichfield Road, approximately 830m north-east of the SAC and SSSI. The SAC and SSSI designations are for lowland heathland and ancient woodland. There will be no significant effect on the designated features of the SAC or SSSI.

8.4.6 A Habitats Regulations Assessment (HRA) Screening Report for the Chartley Moss element of the West Midlands Mosses SAC and Midland Meres and Mosses Phase 1 Ramsar site is provided in Volume 5: Appendix EC-017-005. The HRA Screening Report comprises an assessment of the likelihood that significant air quality impacts to the SAC/ Ramsar site could occur as a result of construction traffic using a route along the A518 Uttoxeter Road, at a distance of approximately 170m from the site.

[110] Volume 5: Appendix CT-003-000, Draft Code of Constructon Practice.

This assessment concludes that there would be no likely significant effect on the qualifying features of the SAC/ Ramsar site from the Proposed Scheme.

8.4.7 A HRA Screening Report was prepared for Pasturefields Salt Marsh SAC at the Appraisal of Sustainability stage, as provided in Volume 5: Appendix EC-017-003. The HRA Screening Report concluded that the Proposed Scheme would not have a significant effect on the SAC, and this conclusion has been agreed with Natural England. Since that screening report was undertaken it has been confirmed that construction vehicles (including heavy goods vehicles (HGVs) will use the A51 Lichfield Road, approximately 60m from the SAC. An assessment of the air quality impacts to the salt meadow vegetation from construction traffic using this road has been undertaken and concluded that there would be no likely significant effect from the Proposed Scheme, as set out in the HRA Screening Report for Pasturefields Salt Marsh SAC Addendum in Volume 5: Appendix EC-017-004.

8.4.8 In addition to the inland salt meadow, Pasturefields Salt Marsh SSSI is also designated for breeding waders. It is considered that there will be no significant effect on these birds because the A51 Lichfield Road is already a busy road and any breeding waders in the vicinity will be accustomed to the traffic noise.

8.4.9 Blithfield Reservoir SSSI will not be affected by the construction of the Proposed Scheme. The closest point of construction in the Colwich to Yarlet area will be underground diversion of an existing 132kV power line adjacent to the Moreton Brook, approximately 1.9km south-east of the SSSI. The SSSI is designated for its bird assemblage, which during winter use the surrounding agricultural land. There will be no significant effect on the designated feature of this SSSI.

8.4.10 Stafford Brook SSSI will not be affected by the construction of the Proposed Scheme. The closest point of construction will be woodland habitat creation on the south side of Moreton North embankment, approximately 2.9km north of the SSSI. The SSSI is designated for its purple moor-grass marshy grassland. There will be no significant effect on the designated feature of this SSSI.

8.4.11 Rawbones Meadow SSSI will not be affected by the construction of the Proposed Scheme. The closest point of construction will be a temporary material stockpile on the south side of Trent North embankment approximately 800m north of the SSSI. The SSSI is designated for its wetland habitats, which support a notable breeding population of snipe. There will be no significant effect on the designated feature of this SSSI.

8.4.12 Baswich Meadows SSSI will not be affected by the construction of the Proposed Scheme. The closest point of construction will be a temporary material stockpile on the south-west side of Brancote South cutting, approximately 2.2km north-east of the SSSI. The SSSI is designated for its wetland habitats, which support a notable breeding populations of snipe, redshank and lapwing. There will be no significant effect on the designated feature of this SSSI.

8.4.13 Doxey and Tillington Marshes SSSI will not be affected by the construction of the Proposed Scheme. The closest point of the construction will be Marston South embankment, approximately 3.1km north-east of the SSSI. The SSSI is designated for its wetland habitats, which support notable breeding populations of snipe, redshank and lapwing. There will be no significant effect on the designated feature of this SSSI.

8.4.14 Construction of Moreton North embankment will result in the permanent loss of approximately 1.7ha (12%) of lowland meadow within Lount Farm LWS. On a precautionary basis, works associated with the underground diversion of an existing 132kV power line will also result in the loss of approximately 2.7ha (39%) of the lowland meadow within Lount Farm LWS in the Colwich to Yarlet area. Lowland meadow will also be lost from Lount Farm LWS in the Fradley to Colton area (CA1), and the combined total loss from this site is 7.7ha (54%). This will result in a permanent adverse effect on the structure and function of the site that is significant at county level.

8.4.15 Construction of the Trent North embankment will result in the permanent loss of approximately 4.5ha (27%) of Lionlodge Covert LWS, which is designated for its lowland mixed deciduous woodland and inland salt meadow. The permanent loss of woodland and salt meadow habitats at Lionlodge Covert LWS will have a permanent adverse effect on the structure and function of the site that is significant at county level.

8.4.16 The widening of Bishton Lane will result in the permanent loss of approximately 3km of native species-rich hedgerows (of which 2km are the feature of interest at Bishton (north of) BAS). Hedgerows form wildlife corridors, which are important for habitat connectivity within an intensively farmed landscape such as this. The permanent loss of hedgerows within Bishton (north of) BAS will result in a permanent adverse effect on the structure and function of the site that is significant at district/borough level.

8.4.17 Construction of the Trent North embankment will result in the permanent loss of approximately 0.2ha (17%) of ancient woodland at Flushing Covert, which is to be added to the AWI. The permanent loss of ancient woodland will result in a permanent adverse effect on this habitat that is significant at up to county level.

8.4.18 Construction of the Brancote South cutting will result in the permanent loss of approximately 0.1ha (34%) of ancient woodland at Town Field Plantation, which is to be added to the AWI. The permanent loss of ancient woodland will result in a permanent adverse effect on this habitat that is significant at up to county level.

8.4.19 Construction of the Yarlet South cutting will result in the permanent loss of approximately 1.3ha (76%) of ancient woodland at The Grove, which is to be added to the AWI. The permanent loss of ancient woodland will result in a permanent adverse effect on this habitat that is significant at up to county level.

Habitats

Woodland

8.4.20 As well as the effects on ancient woodlands described in the designated sites section, there are a number of other woodlands that are affected by the construction of the Proposed Scheme.

8.4.21 Construction of the Trent North embankment will result in the permanent loss of approximately 3ha (19%) of woodland habitat within Lionlodge Covert LWS. The permenant loss of woodland will have a permanent adverse effect that is significant at county level.

8.4.22 Construction of Brancote South cutting will result in the permanent loss of approximately 1ha (33%) of the woodland belt on the west side of Ingestre Park Golf Club. The permanent loss of woodland will have a permanent adverse effect that is significant at up to district/borough level.

8.4.23 Construction of Hopton South cutting will result in the permanent loss of approximately 0.4ha (9%) of Lower Berryhill woodland. The permanent loss of woodland will have a permanent adverse effect that is significant at up to district/ borough level.

Grassland

8.4.24 Construction of the Moreton North embankment, creation of woodland habitat and works associated with the underground diversion of an existing 132kV power line will result in the loss of approximately 8.4ha (46%) of lowland meadow habitat. This is a permanent adverse effect on lowland meadow habitat that is significant at county level.

8.4.25 Construction of the Trent South embankment will result in the permanent loss of approximately 0.9ha (43%) of lowland meadow on the south side of Tolldish Lane, north-east of Great Haywood. The permanent loss of lowland meadow will result in a permanent adverse effect that is significant at up to county level.

8.4.26 Construction of the Great Haywood viaduct will result in the permanent loss of approximately 14ha (21%) of floodplain grazing marsh adjacent to the River Trent. The permanent loss of floodplain grazing marsh will result in a permanent adverse effect that is significant at up to district/borough level.

Hedgerows

8.4.27 On a precautionary basis, it is assumed that all hedgerows (approximately 33.9km) within the land required to construct the Proposed Scheme in the Colwich to Yarlet area will be permanently lost and the remaining hedgerow network fragmented. This includes the native species-rich hedgerows at Bishton (north of) BAS. This total, however, includes some hedgerows that are likely to be retained, such as those located within land required for overhead line diversions/realignments and those located within land required for the creation of woodland and grassland habitat. The combined loss and severance of hedgerows within the land required for the Proposed Scheme will have a permanent adverse effect that is significant at district/borough level.

Watercourses

8.4.28 The route of the Proposed Scheme will cross the River Trent and the Trent and Mersey Canal on the Great Haywood viaduct. These watercourses will not be directly affected, and indirect adverse effects will not be significant as they will be controlled through the implementation of measures that are described in the draft CoCP. However, a series of smaller watercourses will also be permanently diverted, realigned or culverted for the Proposed Scheme, severing the habitat corridors that follow these watercourses. This habitat loss and fragmentation will result in a permanent adverse effect that is significant at up to district/borough level.

Water bodies

8.4.29 On a precautionary basis, it is assumed that all 40 ponds located within the land required for the Proposed Scheme in the Colwich to Yarlet area will be permanently lost. This total, however, includes some ponds that are likely to be retained, such as those located within land required for overhead line diversions/realignments and those located within land required for the creation of woodland and grassland habitat. Where survey has not been possible, a precautionary approach to the assessment has been applied. The loss of ponds within the land required for the Proposed Scheme could lead to a permanent adverse effect on the conservation status of water bodies that will be significant, in each case, at up to district/borough level.

Saltmarsh

8.4.30 Construction of the Trent North embankment will result in the permanent loss of approximately 1.5ha (100%) of inland salt meadow (within the Lionlodge Covert LWS), which has been agriculturally improved. The loss of inland salt meadow will result in a permanent adverse effect that is significant at the county level.

Ancient and veteran trees

8.4.31 It is assumed that seven (out of the eight) veteran trees recorded within the land required for the Proposed Scheme in the Colwich to Yarlet area will be permanently lost. Ancient and veteran trees are an irreplaceable resource and their potential loss will result in a permanent adverse effect that is significant at district/borough level in each case. Where reasonably practicable, measures will be taken to protect and retain ancient and veteran trees within and adjacent to the proposed works area to reduce the number that will be impacted. On a precautionary basis, ancient or veteran trees are assumed to be lost as a result of:

- works associated with the Yarlet South cutting will result in the loss of a veteran oak (Tree 113476 on the Ancient Tree Inventory), located in a field on the north-west side of The Grove at Yarlet Hill;
- works associated with the Brancote South cutting will result in the loss of a veteran lime and a veteran horse-chestnut, located on the south-west side of Ingestre Park Golf Club;
- works associated with Hopton North cutting will result in the loss of a veteran ash located south of Hopton Lane and west of Spode Avenue;
- earthworks to the south of Hopton North cutting will result in the loss of a veteran horse-chestnut located south of Lowerhouse Farm, Hopton within a small woodland; and
- works associated with the A34 Stone Road temporary diversion and Yarlet South cutting will result in the loss of two beech trees located south of Yarlet Bank Farm.

8.4.32 A veteran beech, south of Yarlet Bank Farm, is within land required for grassland habitat creation and the retention of the tree is assumed.

Species

Bats

8.4.33 The removal or disturbance of habitat features that are utilised by bats during breeding, hibernation or migrating between roosts is considered to have the potential to result in adverse effects on the bat populations or assemblages during construction. However, the point at which such impacts are considered likely to result in a significant adverse effect on the population concerned will differ depending on the status of the species concerned.

8.4.34 The impact of disturbance on bat populations will generally be localised and limited to the period of construction. Bats utilising retained habitats may be subject to irregular and localised disturbance from lighting, noise and movement during the construction period where works in autumn, winter and spring may be carried out for short periods after dusk or prior to dawn. These impacts would only temporarily deter bats from using foraging and commuting habitats and the implementation measures that are described in the draft CoCP will reduce potential disturbance affects to a level that is not significant.

8.4.35 Construction has the potential to affect the bat assemblage associated with habitats on the River Trent Floodplain south of Hoo Mill. Construction of the Great Haywood viaduct has potential to result in the temporary disturbance to foraging habitat and commuting corridors along the River Trent and the Trent and Mersey Canal that are used by a regionally important assemblage of bats, including occasional lesser horseshoe. However, due to the abundance of the surrounding habitat, it is likely that all component bat species will continue to forage and commute along the watercourses, hedgerows, and areas of woodland within and adjacent to the Trent floodplain. In addition, no known roosts associated with this assemblage will be removed or disturbed. Therefore, it is unlikely there will be a significant adverse effect on the bat assemblage that utilise the River Trent floodplain.

8.4.36 Construction will affect the bat assemblages at Ingestre Park Golf Club and Upper Hanyards. Construction of Brancote South cutting will result in the permanent loss of a Myotid species maternity roost at Ingestre Park Golf Club, and a whiskered bat maternity roost and brown long-eared maternity roost, both of which are at Upper Hanyards. The maintenance of maternity roosts is important to the continued breeding success of the component species of the bat assemblages present. Construction of Brancote South cutting will also result in the loss of woodland (totalling approximately 1.7ha) and hedgerows, which are used as foraging habitat and for commuting by the assemblage of bats present around Ingestre Park Golf Club. This will reduce the availability of foraging habitat and fragment commuting routes. The direct loss of these roosts and the loss and fragmentation of foraging and commuting habitat will result in a permanent adverse effect on the bat assemblages in the Ingestre Park Golf Club and Upper Hanyards areas, which will be significant at up to regional level.

8.4.37 Construction will affect the bat assemblage associated with habitat near Moreton House. Construction of Moreton cutting will result in the permanent loss of single transitional/day roosts for both a Myotid species and noctule bat near Moreton House. Construction of Moreton cutting will also result in the loss of woodland (totalling

approximately 0.6ha) and hedgerows, which are used as foraging and commuting habitat by the assemblage of bats present between Moreton and Tithebarn Farm. This will reduce the availability of foraging habitat and fragment commuting routes. The direct loss of these roosts and the loss and fragmentation of foraging and commuting habitat will result in a permanent adverse effect on the assemblage of bats associated with habitats near Moreton House, which will be significant at the county level.

8.4.38 Construction will affect the bat assemblage associated with habitats near Hopton. The construction of Hopton South cutting will result in the loss of a noctule transitional/day roost in a tree near Hopton Pools. Construction of Hopton embankment and Hopton South cutting will also result in the loss of woodland (totalling approximately 0.7ha) and the fragmentation of hedgerows, which are used as foraging and commuting habitat by the assemblage of bats present around Hopton. This will reduce the availability of foraging habitat and fragment commuting routes. The direct loss of these roosts and the loss and fragmentation of foraging and commuting habitat will result in a permanent adverse effect on the assemblage of bats associated with habitats near Hopton, which will be significant at the county level.

8.4.39 Construction will affect the bat assemblage associated with habitats at Park Farm, Upper Berryhill. The construction of Hopton embankment will result in the permanent loss of a brown long-eared maternity roost at Park Farm. Construction of Hopton embankment will also result in the loss of woodland and the fragmentation of hedgerows, which are used as foraging and commuting habitat by the assemblage of bats present at Park Farm. This will reduce the availability of foraging habitat and fragment commuting routes. The direct loss of these roosts and the loss and fragmentation of foraging and commuting habitat will result in a permanent adverse effect on the assemblages of bats associated with habitats at Park Farm, Upper Berryhill, which will be significant at the county level.

8.4.40 Loss of other suitable habitats within the land required for the Proposed Scheme may require some bats to travel further, and expend more energy during day to day foraging and movement throughout their home range for the duration of construction. However, such effects alone are for all species considered unlikely to result in sufficient disturbance of the populations or assemblages concerned to result in a permanent adverse effect on their conservation status.

Amphibians

8.4.41 A meta-population of great crested newts (AMP2.1) has been identified associated with 27 ponds that are centred on Moreton Farm. Construction of Moreton North embankment and Moreton cutting will result in the loss of six ponds, one of which is confirmed as supporting great crested newt populations, as well as grassland and hedgerows that that offer terrestrial habitat opportunities for foraging, dispersal and shelter. This will result in a permanent adverse effect on the great crested newt meta-population centred on Moreton Farm, which will be significant at the county level.

8.4.42 A meta-population of great crested newts (AMP2.2) has been identified associated with 12 ponds that are centred on Ingestre Park Golf Club. Construction of Brancote South cutting will result in the loss of two ponds, one of which is confirmed as supporting great crested newt populations, as well as grassland and hedgerows that

that offer terrestrial habitat opportunities for foraging, dispersal and shelter. This will result in a permanent adverse effect on the great crested newt meta-population centred on Ingestre Golf Club, which will be significant at the county level.

8.4.43 A meta-population of great crested newts (AMP2.3) has been identified associated with 10 ponds centred on Hopton Lane. Construction of Hopton North cutting will result in the loss of grassland and hedgerows that offer terrestrial habitat opportunities for great crested newt foraging, dispersal and shelter. This will result in a permanent adverse effect on the great crested newt meta-population centred on Hopton Lane, which will be significant at the county level.

8.4.44 Of the 49 ponds associated with the three GCN metapopulations, 40 are located within the land required for the Proposed Scheme within the Colwich to Yarlet area. Of these, two ponds have been assessed as unsuitable for great crested newts, eight have been accessible for presence/absence survey, and of these, two have been confirmed as supporting great crested newts. In the absence of survey information, the remaining 30 ponds are assumed to support populations of great crested newts. This is highly precautionary and it is likely that a proportion of the un-surveyed ponds do not support great crested newt populations. The loss of any ponds supporting great crested newts would result in a permanent adverse effect on amphibian populations that will be, in each case, significant at up to county level.

Birds

8.4.45 Works associated with the 132kV line underground diversion and construction of the Moreton North embankment will result in the permanent loss of approximately 25% of grassland used for foraging by the barn owl pair at Upper Moreton Farm and on a precautionary basis it is considered that this will result in their displacement from this area. This loss represents a permanent adverse effect on the barn owl pair at Upper Moreton Farm, which will be signficant at the county level.

8.4.46 Construction of the Trent North embankment will result in the permanent loss of curlew breeding and foraging habitat on the grassland south of Lionlodge Covert at Tixall Farm. This loss represents a permanent adverse effect on the curlew populaton at Tixall Farm, which will be significant at the county level.

Other mitigation measures

8.4.47 This section describes other mitigation measures designed to reduce or compensate for significant ecological effects. These include habitat creation and habitat enhancement.

Habitats

Woodland

8.4.48 The Proposed Scheme will result in the combined loss of approximately 1.6ha of ancient woodland, which is irreplaceable, from Flushing Covert, Town Field Plantation and The Grove, each of which is significant at the county level.

8.4.49 In addition, the Proposed Scheme will result in the combined loss of approximately 4.4ha of lowland mixed deciduous woodland at Lionlodge Covert LWS, Ingestre Park

Golf Club and Lower Berryhill, each of which is significant at the county or district/borough level.

8.4.50 There is a further loss and fragmentation from six small woodlands across the Colwich to Yarlet area, including loss of approximately 0.9ha of lowland mixed deciduous woodland and 1.6ha of other woodland habitat, as reported within the register of local/parish effects (Volume 5: Appendix EC-016-002). The combined loss and fragmentation of woodland habitats from these woodlands is significant at the district/borough level.

8.4.51 In accordance with the Ecological Principles of Mitigation in the SMR Addendum, a route-wide, integrated strategic approach has been developed to compensate for loss of woodland. The woodland habitat creation in this area is intended to fulfil the objective of no net loss as far as possible in the local area as well as to ensure that the populations of protected and notable species including bats are maintained. With these objectives in mind, where reasonably practicable, the locations of woodland habitat creation have been selected so as to increase the size of existing higher quality habitat and to increase connectivity.

8.4.52 The loss of ancient woodland will be partly compensated through a range of measures, including the planting of native broadleaved woodland as follows:

- approximately 3.4ha on the south side of Trent North embankment, which will enhance ecological connectivity east of the retained woodland at Flushing Covert. In particular this will partly compensate for the loss of 0.2ha at Flushing Covert and 0.1ha at Town Field Plantation as well as the loss of other woodland habitat in the vicinity;
- approximately 2.2ha in total at two locations on the north side of Brancote South cutting, which will enhance ecological connectivity either side of the retained ancient woodland at Town Field Plantation;
- approximately 1.9ha on the south side of Marston North embankment, which will enhance ecological connectivity with retained hedgerows along Marston Lane;
- approximately 3.2ha in total at two locations on the south side of Yarlet South cutting, which will enhance ecological connectivity between retained woodland at Yarlet Wood. Also, approximately 1.6ha in two locations on the north side of Yarlet South cuttingwill partly compensate for the loss of 1.3ha at The Grove; and
- approximately 1.3ha to connect Ingestre Wood with Lambert's Coppice and help maintain the structure and function of both of these AWI sites.

8.4.53 Woodland planting to partly compensate for the loss of ancient woodlands will include further measures such as translocation of ancient woodland soil with its associated seed bank where appropriate. Other measures such as planting native trees and shrubs of local provenance and translocation of coppice stools and dead wood will be undertaken in accordance with the Ecological Principles of Mitigation within the SMR Addendum.

8.4.54 Within the Colwich to Yarlet area, approximately 40.3ha of further woodland habitat creation will be undertaken to compensate primarily for adverse effects upon non-ancient woodland, at locations including the following:

- approximately 6.7ha the north side of Trent North embankment, which will enhance ecological connectivity between the retained woodland at Lionlodge Covert LWS and Ingestre Park Golf Club;
- approximately 4.4ha either side of Brancote South cutting on the west side of Ingestre Park Golf Club, which will enhance ecological connectivity between the retained woodland at Ingestre Park Golf Club, Ingestre Wood and Hanyards Lane; and
- approximately 5.5ha either side of Hopton South cutting and Trent Walk, which will enhance ecological connectivity between the retained woodland at Lower Berryhill and Upper Berryhill.

8.4.55 The target habitat type for woodland planting is lowland mixed deciduous woodland habitat of principal importance. The new areas of woodland habitat will connect and help maintain the integrity of remaining areas of woodland. A temporary adverse effect is expected until these woodland areas have become established, after which there will be a permanent beneficial effect on lowland mixed deciduous woodland that is significant at district/borough level.

8.4.56 In addition, there will be further areas of landscape planting of native broadleaved woodland, which will also contribute to habitat creation.

Grassland

8.4.57 The Proposed Scheme will result in the loss of approximately 14ha of floodplain grazing marsh adjacent to the River Trent, approximately 0.9ha of lowland meadow from the south side of Tolldish Lane, and approximately 8.4ha of lowland meadow habitat in and adjacent to Lount Farm LWS within the Colwich to Yarlet area, each of which is significant at the county or district/borough level. There is a combined loss of approximately 11.7ha of lowland meadow habitat in and adjacent to Lount Farm LWS across the Fradley to Colton and Colwich to Yarlet areas.

8.4.58 There is a further loss of approximately 10.4ha of semi-improved grassland within the Colwich to Yarlet area as reported within the register of local/parish effects (Volume 5: Appendix EC-016-002). The combined loss of semi-improved grassland from these areas is significant at the district/borough level.

8.4.59 In accordance with the Ecological Principles of Mitigation in the SMR Addendum, a route-wide, integrated strategic approach has been developed to compensate for loss of grassland. The grassland habitat creation in this area is intended to fulfil the objective of no net loss as far as possible in the local area as well as to ensure that the populations of protected and notable species including great crested newts and barn owls are maintained. With these objectives in mind, where reasonable practicable, the locations of grassland habitat creation have been selected so as to increase the size of existing higher quality habitat and to increase connectivity.

8.4.60 Within the Colwich to Yarlet area, grassland habitat creation will be undertaken at locations including the following:

- approximately 2.7ha of lowland meadow at Lount Farm LWS will be restored and enhanced on the west side of Moreton Brook. An additional 2.7ha of species-rich grassland will be created on land to the east side of Moreton Brook within the Fradley to Colton area (CA1). These measures will partly compensate for the loss of 8.4ha of lowland meadow within and adjacent to Lount Farm LWS in the Colwich to Yarlet area (4.4ha of which is within the LWS);
- approximately 4.8ha of native species-rich wetland grassland will be created to the east of Hoo Mill adjacent to the River Trent. In particular, this will compensate for the loss of approximately 0.9ha of lowland meadow from the south side of Tolldish Lane;
- approximately 14ha of floodplain grazing marsh will be reinstated within the River Trent floodplain to compensate for the loss of this habitat during construction of Proposed Scheme; and
- approximately 5ha of wet grassland creation will take place on land to the east of Hoo Mill.

8.4.61 The target habitat type for grassland habitat creation is lowland meadow or floodplain grazing marsh habitat of principal importance, depending on location. A temporary adverse effect upon grassland habitats within the Colwich to Yarlet area is expected until grassland creation areas have become established, after which these measures will reduce the overall effect to a level that is not significant for the majority of grassland areas. The exception is Lount Farm, where there will be a residual effect on lowland meadow due to the net loss of approximately 3ha of this habitat within and adjacent to Lount Farm LWS, which is significant at the district/ borough level.

Hedgerows

8.4.62 New hedgerows will be planted as replacement for those lost as a result of the Proposed Scheme. Where practicable the hedgerows along Bishton (north of) BAS will be translocated to the nearest suitable habitat creation areas. Approximately 31.8km of new hedgerows will be planted and the species composition will be characteristic of the surrounding area. This represents a net loss in hedgerow of approximately 2.1km after mitigation, which represents a residual adverse effect that is significant at the district/borough level. However, opportunities will be sought to retain or replace hedgerows within the land required for the Proposed Scheme for temporary works only. Reinstatement of existing hedgerows within the land required for temporary works would provide approximately 12.8km of hedgerow in addition to the mitigation described.

Watercourses

8.4.63 Where smaller watercourses are diverted, the channel will be naturalised, where possible with a profile to promote the establishment of marginal vegetation and pools. Once the vegetation has developed the adverse effect on these watercourses will be reduced to a level that is not significant.

Water bodies

8.4.64 At least one pond will be created for every pond lost within the Proposed Scheme. New ponds will be established in accordance with the Ecological Principles of Mitigation in the SMR Addendum. Once established, it is anticipated that any adverse effect on pond habitats will be reduced to a level that is not significant.

Saltmarsh

8.4.65 In consultation with Staffordshire Wildlife Trust and local landowners, HS2 Ltd is seeking to identify off-site enhancement measures to compensate for the permanent loss of 1.5ha of inland saltmarsh habitat at Lionlodge Covert LWS. The objective of the proposed measures will be to reduce the adverse effect to the inland saltmarsh to a level that is significant at no more than the local/parish level. In the absence of such measures, the loss of inland saltmarsh represents a residual adverse effect that is significant at the county level.

Ancient and veteran trees

8.4.66 Where practicable, measures will be taken to protect the seven impacted ancient or veteran trees. Where loss is unavoidable, the trees will be soft felled and sections placed within retained habitats to provide a continued deadwood resource. Ancient and veteran trees are irreplaceable and the loss of each of these trees represents a residual adverse effect that is significant at the district/borough level.

Species

Bats

8.4.67 To replace roosts that will be lost to construction, artificial roosting provision will be provided across the Proposed Scheme in accordance with the Ecological Principles of Mitigation within the SMR Addendum. The habitat creation measures detailed above for mitigation of habitat loss, including creation of areas of grassland, hedgerows, new ponds, and semi-natural woodland, will compensate for those bat foraging habitats lost within the land required for the Proposed Scheme as detailed below.

8.4.68 The loss of three maternity roosts for whiskered, brown long-eared bat and an unidentified Myotid species associated with the bat assemblages in the Ingestre Park Golf Club and Upper Hanyards areas will be addressed through the provision of replacement roosting structures on retained mature trees within the woodland belt on the west side of Ingestre Park Golf Club. The loss of foraging and commuting habitat near Ingestre Park Golf Club will be addressed through new habitat planting. Once established, the hedgerows and woodlands planted adjacent to Brancote South cutting will compensate for the loss of foraging habitat associated with the same bat assemblage. The hedgerows and woodlands will connect with the retained habitats in the Ingestre Park Golf Club area to compensate for the impact of fragmentation caused by construction of the cutting. Ingestre green overbridge will be greened primarily to provide connectivity for bats on a precautionary basis. It will be designed to support vegetation that will connect to areas of retained and newly created habitat on either side of the Proposed Scheme and will provide a safe crossing point for bats over the route of the Proposed Scheme. Following implementation of the described measures, the adverse effects on the conservation of the bat assemblages in the

Ingestre Park Golf Club and Upper Hanyards areas will be reduced to a level that is not significant.

8.4.69 The loss of four day/transitional roosts for a Myotid species, noctule, common pipistrelle and soprano pipistrelle associated with the bat assemblage near Moreton House will be addressed through the provision of replacement roosting structures on retained mature trees adjacent to Moreton Brook. The loss of foraging and commuting habitat will be addressed through new habitat planting. Once established, the hedgerows and woodlands planted adjacent to Moreton cutting will compensate for the loss of foraging habitat associated with the same bat assemblage. The hedgerows and woodlands will connect with the existing habitats in the Moreton area to compensate for the impact of fragmentation caused by construction of the cutting. Colwich Bridleway 23 green accommodation overbridge is greened primarily to provide connectivity for bats on a precautionary basis. It is designed to support vegetation that will connect to areas of retained and newly created habitat on either side of the Proposed Scheme and will provide a safe crossing point for bats over the route of the Proposed Scheme. Following implementation the adverse effects on the conservation staus of the bat assemblage associated with habitats near Moreton House will be reduced to a level that is not significant.

8.4.70 HS2 Ltd will seek to continue to survey within the vicinity of the proposed Ingestre green overbridge and Colwich Bridleway 23 green accommodation overbridge locations during the period up to construction, and if it is demonstrated that any of the above measures are not required to maintain connectivity and/or the conservation status of target species, then the mitigation provision may be revised accordingly.

8.4.71 The loss of a summer/day roost for noctule and day/transitional roosts for common pipistrelle brown long-eared bats associated with the bat assemblage in the Hopton area will be addressed through the provision of replacement roosting structures on retained mature trees at Upper Berryhill adjacent to the Staffordshire County Showground. The loss of foraging and commuting habitat will be addressed through new habitat planting. Once established, the hedgerows and woodlands planted adjacent to Hopton embankment and Hopton North cutting and Hopton South cutting will compensate for the loss of foraging habitat associated with the same bat assemblage. The hedgerows and woodlands will connect with the retained habitats in the Hopton area to compensate for the impact of fragmentation caused by construction of the cutting and embankment. The Trent Walk underbridge will provide space for the passage of wildlife, including bats. Planting at either end of the underbridge, connected to both retained and newly created habitats either side of the Proposed Scheme, will guide species through it. Following implementation of these measures, the adverse effects on the bat assemblage in the Hopton area will be reduced to a level that is not significant.

8.4.72 The loss of a brown long-eared maternity roost associated with the bat assemblage at Park Farm, Upper Berryhill will be addressed through the provision of replacement roosting structures near areas of retained habitat at Upper Berryhill, adjacent to the Staffordshire County Showground. Given their proximity to Upper Berryhill, the habitat creation measures and provision of connectivity under the Proposed Scheme described above for the bat assemblage in the Hopton area will also mitigate the loss of foraging habitat and fragementation effects for this bat assemblage.

Following implementation of these measures, the adverse effects on the bat assemblage associated with habitat at Park Farm, Upper Berryhill will be reduced to a level that is not significant.

Amphibians

8.4.73 Provision of ponds, species-rich neutral grassland and broadleaved woodland will be designed to compensate for the loss of breeding sites, foraging habitat and places of shelter used by great crested newts and other amphibian species. Compensation will be provided within the ecological habitat creation areas at Moreton, Ingestre Park Golf Club, Marston and Yarlet. Ponds, grassland and woodland will be established in accordance with the Ecological Principles of Mitigation within the SMR Addendum. Following implementation, the adverse effects on the amphibian populations in the Fradley to Colton area (CA1) will be reduced to a level that is not significant. Hs2 Ltd will continue to survey ponds for great crested newt populations, where it is confirmed that populations are absent then pond and terrestrial habitat provision will be re-assessed.

Birds

8.4.74 Habitat creation measures, including the provision of grassland habitat creation north of Upper Moreton Farm and north-west of Moreton Grange Farm, will provide replacement foraging opportunities for the barn owl population at Upper Moreton Farm. Once the habitats have become established, the adverse effect resulting from the loss of foraging habitat on the barn owl population at Upper Moreton Farm will be reduced to a level that is not significant.

8.4.75 To compensate for the loss of curlew breeding and foraging habitat, a 5ha wetland habitat will be created on the River Trent floodplain between Great Haywood and Hoo Mill. It is expected that the provison of wet tussocky grassland and shallow pools will provide breeding and foraging habitat for curlew and other wading birds. Following implementation the adverse effect on the loss of breeding and foraging habitat for curlew will be reduced to a level that is not significant.

Badger

8.4.76 Although there will be no significant effects on badger populations in this area, mitigation measures to address the potential disturbance of badgers will be provided in accordance with the Ecological Principles of Mitigation within the SMR Addendum. This will include the provision of badger proof fencing and replacement setts where necessary.

Summary of likely residual significant effects

8.4.77 This section describes anticipated significant residual ecological effects during construction, taking into account the mitigation and compensation proposed.

8.4.78 There will be a residual effect due to the loss of 1.5ha of inland saltmarsh habitat at Lionlodge Covert LWS that is significant at the county level. However, if suitable offsite compensatory measures are provided, this adverse effect will be reduced to a level that is significant at no more than local/parish level.

8.4.79 There will be a permanent residual effect due to the net loss of 3.1ha of lowland meadow habitat of principal importance at Lount Farm LWS and surrounds that is significant at the district/ borough level. However, in consultation with Staffordshire Wildlife Trust and local landowners, suitable offsite compensatory measures are being sought in order to reduce this permanent adverse effect to a level that is significant at no more than local/parish level.

8.4.80 Ancient woodland is irreplaceable and the loss of 1.6ha of this habitat will result in a permanent adverse residual effect upon ancient woodland that is significant at the county level.

8.4.81 Extensive new woodland planting at several sites within the Colwich to Yarlet area will increase the area of broadleaved woodland and enhance woodland connectivity. This will result in a permanent beneficial residual effect on lowland mixed deciduous woodland habitat that is significant at district/borough level.

8.4.82 On a precautionary basis, it is assumed that there is a net loss in hedgerow of approximately 2.1km, which will result in a permanent adverse residual effect that is significant at the district/borough level. However, restoration of land required only during the construction of the Proposed Scheme to its current use offers potential for reinstatement of a further 12.8km of existing hedgerow. The provision of the majority of this reinstated hedgerow would reduce the residual effect to a level that is not significant.

8.4.83 The assumed loss of seven veteran trees will result in a permanent adverse residual effect that is signicant at district borough/level.

Cumulative effects

8.4.84 No cumulative effects on ecological receptors have been identified in the Colwich to Yarlet area.

8.5 Effects arising from operation

Avoidance and mitigation measures

8.5.1 Within this section of the Proposed Scheme the following elements of the design will avoid or reduce impacts on features of ecological value during operation:

- Great Haywood viaduct will provide ecological connectivity under the route of the Proposed Scheme to adjacent habitats. Ecological connectivity beneath the route of the Proposed Scheme will be maintained for a length of 780m of viaduct in the Colwich to Yarlet area. This will reduce habitat fragmentation, allowing free passage of wildlife at these locations;
- Colwich Bridleway 23 green overbridge and Ingestre green overbridge will support vegetation to provide ecological connectivity adjacent habitats. This will reduce habitat fragmentation by providing a wildlife movement corridors over the route of the Proposed Scheme at these locations;
- Trent Walk underbridge will provide ecological connectivity to adjacent habitats. This will reduce habitat fragmentation by providing a wildlife

movement corridor beneath the route of the Proposed Scheme at this location;

- a further eight overbridges and three underbridges will maintain farm access and/or public access on footpaths or bridleways across or beneath the route of the Proposed Scheme. These structures will be of a sufficient size to also allow for the passage of a range of wildlife species, and their primary purpose will not discourage use by most wildlife species. These overbridges and underbridges will reduce barrier effects by facilitating wildlife movement across the Proposed Scheme; and
- where the route of the Proposed Scheme crosses a watercourse, a culvert or dry tunnel will be provided to allow passage for mammal such as otter and water vole.

Assessment of impacts and effects

8.5.2 Significant effects arising during operation at the district/borough level or above are described below. Significant effects on ecological features at the local/parish level are listed in Volume 5: Appendix EC-016-002.

Species

Bats

8.5.3 The operation of the Proposed Scheme has the potential to result in a variety of impacts on bat populations including those as a result of collision with passing trains, turbulence and noise. The point at which such impacts are considered to result in a significant adverse effect on the conservation status of the population concerned will differ between species. As a consequence, the following assessment of operational impacts takes into account the differing character and nature of the bat populations and/or assemblages concerned in determining the likely effects of the Proposed Scheme on each of these receptors.

8.5.4 Due to the large areas over which bats forage it is likely that any loss of, or displacement from, suitable foraging habitat in the vicinity of the Proposed Scheme will in itself amount to only a small proportion of the wider available resource. However, the impact of any such disturbance or displacement could be greatly increased if bats are hampered in moving between breeding sites, hibernation sites and other roosts which they commonly utilise.

8.5.5 Noise, vibration and lighting associated with passing trains have the potential to disturb bat species foraging and commuting within habitats close to the Proposed Scheme. Understanding of the impact of noise on bats caused by passing trains is limited. Research suggests that gleaning bats, such as brown long-eared, will have reduced foraging success in areas where there is persistent noise from busy roads[111]. However, noise generated from passing trains will be regular but temporary and as such will differ from that resulting from a busy road.

[111] Schaub, A., Ostwald, J. & Simeers, B.M. (2008), Foraging bats avoid noise. *Journal of Experimental Biology*, **211**, 3174-3180.

8.5.6 Where the route of the Proposed Scheme bisects, or is located in proximity to existing features known to be utilised regularly by foraging or commuting bats, there is an increased risk that bats could be killed or injured as a result of collisions with passing trains or associated turbulence. The significance of any such effect will be dependent on both the flight height range of the species and the vertical alignment of the Proposed Scheme (i.e. whether the railway is in cutting, at grade or on embankment) at the point the impact occurs.

8.5.7 Bats that forage/commute along the Moreton Brook (located in the Fradley to Colton area (CA1)) and also the River Trent and Trent and Mersey Canal will not be obstructed either by the Moreton viaduct (located in the Fradley to Colton area (CA1)) or the Great Haywood viaduct. The proposed woodland belts and hedgerows have been designed to channel bats towards safe crossing areas. Bats that forage/commute along on the western side of Ingestre Park Golf Club will be encouraged to fly over the route of the Proposed Scheme by tree planting on and either side of Ingestre green overbridge. Bats that forage/commute at the woodland known as Little Covert will be encouraged to fly over the route of the Proposed Scheme by tree planting on and either side of Colwich Bridleway 23 green overbridge. Bats that forage/commute along the east side of the Staffordshire County Showground will be encouraged to fly beneath the route of the Proposed Scheme by tree planting either side of the Trent Walk underbridge.

8.5.8 Although it is possible that there may be infrequent incidental mortality of individual bats, due to the avoidance measures described above and the availability of alternative foraging and commuting habitat on either side of the Proposed Scheme, this is unlikely to result in a significant adverse effect on the conservation status of the bat assemblages present in the Colwich to Yarlet area.

Birds

8.5.9 The majority of bird species that are known to be present in the area are not considered to be particularly vulnerable to collision with trains. However, barn owls hunt low over the rough grassland habitats that are associated with railway embankments and are slow moving and therefore subject to likely collision with high speed trains. One pair of barn owls breeding in the vicinity of the Proposed Scheme will be affected, at Upper Moreton Farm (located on the boundary with the Fradley to Colton area (CA1)). Research undertaken by the British Trust for Ornithology on behalf of HS2 Ltd suggests that there may be effects on barn owls up to 3km away[112]. This means that more barn owls are likely to be affected than those in the vicinity of the Proposed Scheme identified above. This would result in a permanent residual adverse effect that will be significant at the county level.

Other mitigation measures

8.5.10 HS2 Ltd will seek to identify opportunities to provide barn owl nesting boxes and enhance barn owl habitat up to 3km from the Proposed Scheme in consultation with local landowners. A barn owl action plan will be prepared to identify the measures that can be implemented to help offset the effects. As the availability of nesting sites

[112] Pringle, H., Siriwardena, G. & Toms, M. (2016), *Research Report 692: Informing best practice for mitigation and enhancement measures for Barn Owls*. British Trust for Ornithology, Thetford.

is a limiting factor for this species the implementation of these measures is likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.

Summary of likely residual significant effects

8.5.11 The mitigation, compensation and enhancement measures described above are likely to reduce the residual ecological effects during operation to a level that is not significant, except for barn owl. Collision with trains is likely to result in the loss of barn owls that nest within 3km of the route resulting in a residual significant effect at the county level. However, provided the proposed mitigation measures for barn owl are implemented through liaison with landowners, the residual effect on barn owl would be reduced to a level that is not significant.

Cumulative effects

8.5.12 No cumulative effects on ecological receptors have been identified in the Colwich to Yarlet area.

Monitoring

8.5.13 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

8.5.14 There are no area-specific requirements for monitoring ecology and biodiversity effects or mitigation during the operation of the Proposed Scheme in the Colwich to Yarlet area.

9 Health

9.1 Introduction

9.1.1 This section identifies the communities within the Colwich to Yarlet area that will 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, where these effects are considered to be consequential.

9.1.2 Engagement with key public health bodies has been undertaken to inform the health assessment process. The assessment also draws on health related information and views expressed in consultation responses from Staffordshire County Council (SCC), the parish councils of Ingestre with Tixall, Colwich, Hopton and Coton, Whitgreave and Marston, and the operators of community facilities including Upper Moreton Farm, Mayfield Children's Home, Ingestre Park Golf Club, Ingestre Hall Residential Arts Centre, The Orangery at Ingestre, Staffordshire County Showground and Yarlet School.

9.1.3 This section deals specifically with impacts at a local level within the Colwich to Yarlet area. Health effects assessed across the Proposed Scheme as a whole are reported in Section 8 of Volume 3: Route-wide effects.

9.1.4 Further details of the health assessment, including the application of assessment criteria supporting the conclusions presented in this section, are contained in Volume 5: Appendix HE-001-002 Health assessment matrix.

9.1.5 Maps showing the location of the key environmental features (Map Series CT-10), construction features (Map Series CT-05), and key operational features (Map Series CT-06) of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

9.1.6 In addition, the community health profile for the Colwich to Yarlet area is set out in Background Information and Data (BID)[113] (BID-HE-002-002).

9.2 Scope, assumptions and limitations

9.2.1 The scope, assumptions and limitations for the health assessment are set out in Volume 1 (Section 8) and the Scope and Methodology Report (SMR)[114].

9.2.2 As set out in the SMR, the health assessment is based on a broad understanding of health, consistent with the World Health Organization (WHO) definition of health as 'a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity'[115]. An individual's health is mostly determined by genetics and lifestyle factors, but for a large enough population many other factors, or 'health determinants', are known to be important, and these factors may be affected by the Proposed Scheme.

[113] HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at: www.gov.uk/hs2
[114] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[115] World Health Organization, 1948: Constitution of the World Health Organization Basic Documents, 45th edition supplement. Available online at: www.who.int/governance/eb/who_constitution_en.pdf

9.2.3 The assessment has considered the impacts of the Proposed Scheme on a range of environmental and socio-economic health determinants, which could result in adverse or beneficial effects on health and wellbeing. This process is documented in the health assessment matrices in Volume 5: Appendix HE-001-002. Based on this a professional judgement has been made to identify those effects on population health and wellbeing that are sufficiently important to report within the health assessment sections found in this report and Volume 3: Route-wide assessment.

9.2.4 The health determinants of relevance to the assessment within the Colwich to Yarlet area are:

- impacts during construction (temporary and permanent):
  - neighbourhood quality;
  - access to services, health and social care;
  - access to green space, recreation and physical activity; and
  - social capital; and
- impacts during operation (permanent):
  - neighbourhood quality; and
  - access to services, health and social care.

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

9.2.6 The health assessment methodology is based, in part, on a review of published evidence showing how impacts on health determinants are linked to health 'outcomes' (i.e. effects) in a large population. The evidence varies in its strength; for example, the evidence linking physical activity to health outcomes is strong, whereas the evidence linking social capital with health outcomes is moderate. The strength of evidence does not necessarily determine the importance of a health effect, but is an indication of the level of certainty in the assessment. Additionally, there is greater certainty in the prediction of an impact on a health determinant than the consequent effect on health.

9.2.7 There is no established or widely recognised framework for assessing the significance of health effects caused by a development proposal. The SMR sets out a methodology for describing the impacts on health determinants in terms of the magnitude and duration of the change and the extent of the population exposure to this change. It also draws attention to the strength of evidence that links a change in health determinant with health effects. This framework permits the assessment to describe the impacts on determinants in a largely qualitative manner, with some structure to the relative scale of these impacts to give a sense of the importance of the potential health effects. However, this does not provide a definitive basis for drawing conclusions as to whether a health effect is likely to be 'significant'.

9.3 Environmental baseline

Existing baseline

Demographic and health profile of the Colwich to Yarlet area

9.3.1 The Colwich to Yarlet area covers approximately 15.2km of the Proposed Scheme in Staffordshire. The route will run through mainly rural areas comprising agricultural land with individual dwellings and small clusters of dwellings. The hamlet of Moreton and villages of Ingestre, Tixall, Hopton, Marston and Yarlet lie along the route of the Proposed Scheme.

9.3.2 The larger settlements of Great Haywood and Little Haywood and the town of Stafford lie to the south of the Proposed Scheme. The towns of Rugeley, to the south, and Stone, to the north, lie just outside this area and serve the Colwich to Yarlet community. The Proposed Scheme will cross the A51 Lichfield Road, the A518 Weston Road and the A34 Stone Road as well as numerous rural roads linking the rural community to services and facilities in these larger settlements.

9.3.3 The wards[116] directly affected by the Proposed Scheme in the Colwich to Yarlet area have a relatively low population density, commensurate with the rural nature of the land use. Data provided by the Office of National Statistics[117] and the Association of Public Health Observatories[118] show that the population in the Colwich to Yarlet area is, by comparison with national (England) averages, generally in good health and experiences low levels of deprivation.

9.3.4 The population in this area is considered to be more resilient than average nationally, with regard to changes in the relevant health determinants. However, around two thirds of the route of the Proposed Scheme in this area, including Ingestre, Hopton, Marston and Yarlet, falls within areas that are ranked in the 10% most deprived in the country for access to affordable housing and good quality services.

9.3.5 The available data permit a profile to be made of the whole population in the Colwich to Yarlet area and provides detail down to ward level. The description of the population within the Colwich to Yarlet area as a whole and the populations within wards does not exclude the possibility that there will be some individuals or small groups of people who do not conform to the overall profile. Detailed community profile data are presented in Background Information and Data: BID-HE-002-002, Community area health profile.

9.3.6 For the purposes of the health assessment, the Colwich to Yarlet area is divided into communities as described below.

[116] Electoral wards are the spatial units used to elect local government councillors.
[117] The Office of National Statistics (ONS) provides spatial data on levels of deprivation, using indicators of: 'multiple deprivation', 'employment', 'education', 'barriers to housing and social services', 'crime' and 'living environment'. These data are available by Lower Super Output area.
[118] Public Health Observatories (PHOs) are part of Public Health England. They produce information, data and intelligence on people's health and health care for practitioners, commissioners, policy makers and the wider community. Available online at: http://www.apho.org.uk/

Description of communities in the Colwich to Yarlet area

Moreton and surrounds

9.3.7 This area extends from the eastern edge of the Colwich to Yarlet area to Tolldish Lane. It comprises farmland to the east of the A51 Lichfield Road with scattered farms and individual dwellings centred around the hamlet of Moreton. This hamlet comprises of approximately 13 residential properties, located approximately 1.9km north-east of Little Haywood. Other rural dwellings in this area include Far Coley Farm to the south of Moreton, Horse Shoes on Bishton Lane and Tithe Barn Farm, to the east of Moreton.

9.3.8 Upper Moreton Farm is located to the south of the Proposed Scheme. The Farm is a Community Interest Company (CIC) that provides care services alongside being a working farm and is part of the Care Farming UK initiative, and receives commissions by referral agencies such as SCC, health care trusts, community mental health teams, education authorities, and probation services. It provides educational visits for local schools, and rural therapy and care farming for people with mental health problems, multiple learning difficulties, emotional difficulties, and people who have experienced abuse or neglect.

9.3.9 Mayfield Children's Home is located immediately north of the Proposed Scheme. The home provides residential accommodation for up to 23 pupils at Rugeley School, with autism (ASD) and moderate to severe learning difficulties from the ages of 5 to 19.

9.3.10 Colwich Bridleway 23 and Colwich Footpath 36 cross the route of the Proposed Scheme in the Moreton area, as well as four further rural public rights of way (PRoW) west of Moreton.

Great Haywood and surrounds

9.3.11 This area extends from Tolldish Lane in the east to Mill Lane in the west. It includes the villages of Great Haywood and Little Haywood to the south of the Proposed Scheme, properties along Tolldish Lane and Hoo Mill Lane. Great Haywood contains a range of shops and services that serve the village and surrounding rural communities.

9.3.12 Great Haywood Marina and Hoo Mill Basin, with moorings, shops and cafe, lie to the north of Great Haywood, adjacent to the route of the Proposed Scheme.

9.3.13 Colwich Footpath 63 (the canal towpath) runs alongside the Trent and Mersey Canal and will be crossed by the Proposed Scheme.

Ingestre and surrounds

9.3.14 This area extends from Mill Lane in the east to Hanyards Lane in the west. It includes the villages of Ingestre and Little Ingestre, which comprise approximately 76 residential properties in total and share a single route of entry, via Ingestre Park Road. Community facilities within the villages of Ingestre and Little Ingestre include St. Mary's Church, The Orangery, which hosts community events, and Ingestre Hall Residential Arts Centre, which provides residential arts based programmes for school and community groups. Ingestre Stables provide an equestrian training and examination centre, including indoor and outdoor facilities. Little Ingestre residential

care home for the disabled is a specialist facility for young adults with physical and learning disabilities.

9.3.15 The 18 hole Ingestre Park Golf Club lies on the route of the Proposed Scheme.The club house facilities are used for a variety of social and recreational events. Tixall Park lies to the south of the golf club. Tixall Footpath 0.1630(b) and Tixall Bridleway 0.1628 are crossed by the route of Proposed Scheme to the west of Ingestre.

Hopton and surrounds

9.3.16 This area extends from Hanyards Lane in the east to the B5066 Sandon Road in the west. It includes Staffordshire County Showground, a multi-purpose venue comprising exhibition halls, conference suites, a 600 seat grandstand and caravan and camping facilities for use on show days. Park Farm, Stafford is a small hamlet made up of seven residential properties, within the original farmhouse and converted outbuildings. They are accessible via Trent Walk off the A518 Weston Road, located adjacent to the Staffordshire County Showground, approximately 1km north of the edge of Stafford.

9.3.17 The village of Hopton contains approximately 160 dwellings, including approximately 40 residences located within the community around Mount Edge. Community facilities within the village include St. Peter's Church, playing fields and a village hall.

9.3.18 Hopton and Coton Footpaths 24 and 6 are crossed by the route of the Proposed Scheme to the west of the showground, as well as Hopton and Coton Bridleway 12 to the west of Hopton.

Marston and Yarlet

9.3.19 This area comprises the adjoining hamlets of Marston and Yarlet, with approximately 56 residential properties, and properties along Marston Lane, Yarlet Lane and the A34 Stone Road. Yarlet School, to the east of the A34 Stone Road, provides independent education for children aged between two and 13 years old. The school grounds include a chapel, and overnight accommodation for part time boarding.

9.3.20 Five rural PRoW are crossed by the route of the Proposed Scheme in this area.

Future baseline

9.3.21 A future baseline profile of the Colwich to Yarlet area has been established to forecast the changing demographic characteristics and potential health needs of local communities. The population in Stafford, which includes the Colwich to Yarlet community area, is expected to grow by 5% between 2012 and 2021 with significant growth in people aged 65 and over (23%) and in particular those aged 85 and over (37%)[119]. By 2021, the proportion of the Staffordshire population aged 16-64 is expected to decline by between 3-5 percentage points[120]. The ageing population may put pressure on certain areas of the health service; for example, the prevalence of

[119] Stafford and Surrounds Health and Wellbeing Group; Stafford Enhanced Joint Strategic Needs Assessment, 2014; Available online at:http://www.staffordbc.gov.uk/live/Documents/Environmental%20Health/Health%20and%20Wellbeing/Stafford-EJSNA-2014.pdf

[120] Staffordshire County Council; Staffordshire and Stoke-on-Trent Economic Review, 2016; http://www.staffordbc.gov.uk/live/Documents/Forward%20Planning/Examination%20Library%202013/E15-STAFFORDSHIRE-AND-STOKE-ON-TRENT-ECONOMIC-REVIEW-2013.pdf

dementia is forecast to increase from 1,980 cases in 2015 to 3,330 by 2030[121].A detailed review of future baseline data is presented in Background Information and Data: BID-HE-002-002, Community health profile.

Construction (2020)

9.3.22 Volume 5: Appendix CT-004-000 provides details of committed developments in the Colwich to Yarlet area that are assumed to have been implemented by 2020.

9.3.23 The committed developments that materially affect the baseline conditions in this area and form part of the future baseline assessment of the effects during construction and operation are listed in Table 17.

Table 17: Committed developments relevant to health

Map book reference[122]	Planning reference	Description
CA2/10	14/21135/OUT	Development of up to 45 dwellings.
CA2/7	13/19534/OUT	Development of up to 76 dwellings and associated development including open space, highways and infrastructure.
CA2/18	Policy SA2 Roseacre Nursery	Allocation for a medical centre.
CA2/41	Policy Stafford 2 North of Stafford – Housing	Allocation for two housing sites for around 3,100 dwellings in total.
CA2/ 8	13/19532/OUT	Development of 77 dwellings.
CA2/9	Policy CLE4 Hazeldene House	Allocation for the development of a surgery site for retail and office use.
CA2/11	SA1 Canal Side Site	Allocation for recreation and leisure facilities.
CA2/13	Policy Stafford 4 East of Stafford	Adopted strategic development of 20ha of employment land.
CA2/30	Policy E3 Pasture fields Industrial Estate	New economic development within the recognised industrial estate.

Operation (2027)

9.3.24 Volume 5: Appendix CT-004-000 provides details of committed developments in the Colwich to Yarlet area that are assumed to have been implemented by 2027.

9.3.25 No further committed developments have been identified in this area that will alter the baseline conditions in 2027 for health receptors.

[121] Staffordshire Partnership; Staffordshire Joint Strategic Needs Assessment, 2013; https://www.staffordshirepartnership.org.uk/Health-and-Wellbeing-Board/Staffordshire-E-JSNA-2013-FINAL.pdf

[122] Volume 5 Map Book: Maps CT-13-105b to CT-13-109a-R1.

9.4 Effects arising during construction

Avoidance and mitigation measures

9.4.1 Consideration of potential health issues is an integral part of the planning and design of the Proposed Scheme, alongside consideration of other environmental, community and economic issues. Adverse impacts on health determinants have been reduced insofar as reasonably practicable through mitigation measures incorporated into the design of the Proposed Scheme to reduce adverse effects on people.

9.4.2 The mitigation measures incorporated into the design of the Proposed Scheme in the Colwich to Yarlet area include:

- reducing the proximity of the Proposed Scheme to property and community assets, insofar as reasonably practicable. For example, the route has been moved further away from residential properties at Moreton, Hopton, Marston and Yarlet;
- maintaining access across the route of the Proposed Scheme, for example, between Mount Edge and the rest of Hopton village (via the Hopton and Coton new footpath overbridge), to properties on Tolldish Lane (via the Tolldish Lane temporary highway diversion), and properties and businesses on the A34 Stone Road (via the A34 Stone Road temporary diversion); and
- maintaining accesses across the route of the Proposed Scheme at Bishton Lane (via the Colwich Bridleway 23 accommodation green overbridge), to the residential properties at Park Farm (via Trent Walk underbridge) and between Mount Edge and the rest of Hopton village (via the Hopton and Coton new footpath overbridge).

9.4.3 HS2 Ltd will require its contractors to comply with the environmental management regime for the Proposed Scheme, which will include the Code of Construction Practice (CoCP), which provides a general basis for route-wide construction environmental management.

9.4.4 The CoCP will be the means of controlling the construction works associated with the Proposed Scheme to ensure that the effects of the works upon people and the natural environment are reduced or avoided so far as reasonably practicable.

9.4.5 The CoCP will require the nominated undertaker and its contractors to produce and implement a community engagement framework and provide appropriately experienced community relations personnel to implement the framework, to provide appropriate information and to be the first point of contact to resolve community issues. The nominated undertaker will take reasonable steps to engage with the community, particularly focusing on those who may be affected by construction impacts, including local residents, businesses, landowners and community resources, and the specific needs of protected groups (as defined in the Equality Act 2010).

Assessment of impacts and effects

Neighbourhood quality

9.4.6 The term 'neighbourhood quality' is used in this assessment to describe a combination of factors that have the potential to affect residents' experience of and feelings about their local environment. If these factors are altered to a sufficient degree, there will be effects on mental health and wellbeing. The Proposed Scheme will affect the quality of neighbourhoods through environmental changes resulting from the presence of construction sites, construction activities and construction traffic on local roads. This section assesses how changes to neighbourhood quality may influence people's level of satisfaction with their local environment and perceptions about issues such as personal safety and security.

9.4.7 A review of published research evidence linking neighbourhood quality with health and wellbeing can be found in Volume 5: Appendix HE-003-000[123]. The evidence linking the individual aspects of neighbourhood quality with health outcomes ranges from moderate to strong. The environmental effects of the Proposed Scheme related to this section are assessed in Section 5, Air quality, Section 11, Landscape and visual, Section 13, Sound, noise and vibration and Section 14, Traffic and transport.

9.4.8 The assessment of neighbourhood quality is guided by the findings from other assessments, but does not rely on significance thresholds used in these assessments since these do not relate specifically to health. Instead, it assesses qualitatively how the Proposed Scheme is likely to alter local amenity and perceptions about neighbourhood quality, and consequently may affect health and wellbeing. A review of the pathways through which the construction of the Proposed Scheme may impact on neighbourhood quality, and the potential for health effects, is documented in Volume 5: Appendix HE-001-002. The air quality assessment shows that, following mitigation, impacts on air quality (including dust) resulting from the construction and operation of the Proposed Scheme will be very small and are not expected to affect health and wellbeing adversely, air quality impacts are not considered to contribute to any impacts on neighbourhood quality in this area.

9.4.9 This assessment has, therefore, considered temporary and, where applicable, permanent impacts including:

- noise emissions, affecting local amenity;
- visual impacts affecting residents' satisfaction with their living environment and 'sense of place'; and
- construction traffic on local roads, causing disturbance and concerns about safety.

9.4.10 The construction of the Proposed Scheme will have temporary and permanent impacts on neighbourhood quality in areas close to construction sites, including Moreton, Great Haywood, Park Farm, Hopton, Marston and Yarlet. Impacts on neighbourhood quality have the potential to affect the wellbeing of residents

[123] Volume 5: Appendix HE-003-000, Route-wide commentary on health evidence base.

adversely during the construction phase, by giving rise to negative feelings in relation to quality of life and the local environment, and potentially changing behaviours, such as deterring the use of outdoor space.

9.4.11 At Moreton, the construction of the Moreton North embankment and Moreton Brook viaduct (in the Fradley to Colton area (CA1)) will be visible from Bishton Lane and other local PRoW, as well as from residential properties in elevated positions such as Moreton Cottages. The distinctive character of Bishton Lane will be affected by widening works and loss of vegetation. Construction noise will be very noticeable along Bishton Lane and in private gardens. Residents living in Moreton are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, both in diminishing the amenity of the hamlet and in reducing the sense of its rural character and tranquillity.

9.4.12 The construction of the Great Haywood viaduct to the north of Great Haywood will be visible from street level and from the gardens of approximately 10 dwellings on Tolldish Lane and six dwellings on Hoo Mill Lane, as well as from the A51 Lichfield Road and adjacent footpath approaching Great Haywood from the north, Hoo Mill Basin, community facilities at Great Haywood Marina, and the canal towpath recreational route. Construction traffic, including heavy goods vehicles (HGV), will be present on the A51 Lichfield Road north and south of Great Haywood. Noise from construction activities and construction traffic will be noticeable along Toldish Lane and the canal towpath. Residents on Tolldish Lane and Hoo Mill Lane are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse. Residents within Great Haywood are likely to regard the changes to the north of the village, including impacts at Great Haywood Marina, the canal towpath and the A51 Lichfield Road, as adversely affecting the overall quality of their neighbourhood.

9.4.13 Embankment construction works will be visible from approximately six properties at Park Farm, Stafford, near Staffordshire County Showground, and construction noise will be noticeable in outdoor areas. Construction traffic, including HGVs, will be present on the A518 Weston Road. Residents in Park Farm may experience these features as changing the quality of their neighbourhood adversely.

9.4.14 The construction of Hopton Cutting will be highly visible from the gardens of properties along the southern edge of Hopton village and the north-east side of Mount Edge. It will also be visible from the seating area in the centre of the village, and intermittently from street level throughout the village. Construction noise will be very noticeable in outdoor areas throughout Hopton and north eastern parts of Mount Edge. Residents living in Hopton are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, both in diminishing the amenity of the village and in reducing the sense of its rural character and tranquility.

9.4.15 The construction of the Marston North embankment will be visible from street level and private gardens in Marston, including from the rear of properties on the north side of Yarlet Lane, and from the church and public house in the centre of the village. Construction traffic, including HGVs, will be present on Marston Lane to the south of the Proposed Scheme. Noise from construction activities and construction traffic will be noticeable along Yarlet Lane and Marston Lane, and from private gardens.

Residents living in Marston are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse. The presence of construction traffic on Marston Lane is also likely to give rise to concerns about road safety within the village, which may contribute to perceptions of reduced neighbourhood quality.

9.4.16 Additionally, the quality of the environment around Mayfield Children's Home in Moreton will be severely impacted by noise and visual impacts due to loss of vegetation and construction activities in proximity to the home. Although each child is different, autistic children are generally very sensitive to change and are, therefore, vulnerable to health and wellbeing effects resulting from impacts on their environment and routine. The children have individual plans and routines, which will have to change if they are no longer able to use the altered outside spaces. During the noisiest construction periods, noise levels at the property over a day are likely to be up to 20dB greater than the baseline levels, with higher levels for short durations. Individuals with ASD can be hypersensitive to noise and sometimes specific frequencies of sound. Sounds can become magnified, distorted or muddled and affected individuals may struggle to cut-out background noises, which can lead to difficulties in concentrating[124].

9.4.17 Given the particular sensitivity of children at the home to changes in their environment, it is very likely that, without mitigation, the Proposed Scheme is likely to adversely affect the health and wellbeing of pupils at Mayfield Children's Home. HS2 Ltd will continue to engage with the owners and occupiers of the home to develop mitigation measures that will reduce or avoid impacts on vulnerable users.

Access to services, health and social care

9.4.18 There is strong evidence linking access to healthcare facilities with health outcomes, and there is also weak to moderate evidence to suggest that transport problems are a key barrier to people's ability to access these services. There is moderate evidence to suggest that access to shops and other local services can affect health. This is based on a range of factors affecting quality of life, and includes issues such as reducing feelings of isolation and enabling participation in society, as well as accessing basic needs such as food shopping. A review of published research evidence linking access to services, health and social care with health and wellbeing can be found in Volume 5: Appendix HE-003-000.

9.4.19 A review of the pathways through which the construction of the Proposed Scheme may impact on access to services, health and social care, and the potential for health effects, is documented in Volume 5: Appendix HE-001-002. This has identified temporary and permanent impacts on the services provided at Upper Moreton Farm. The services provided at Upper Moreton Farm are dependent upon its tranquil rural setting. Construction of the Proposed Scheme will result in loss of land and in noise and visual impacts, which are likely to affect adversely the operation of the facility including in particular activities that currently take place outdoors.

[124] The National Autism Society; www.autism.co.uk

9.4.20 Any significant reduction in the range and quality of services available at the farm may adversely affect the health and wellbeing of vulnerable users, such as those with mental health problems, multiple learning difficulties, ASD and emotional difficulties, by limiting opportunities for therapeutic activities. HS2 Ltd will continue to engage with the owners and occupiers of the farm to develop mitigation measures that will reduce or avoid impacts on vulnerable users.

Access to green space and physical activity

9.4.21 There is moderate evidence to show that access to green space contributes to good mental health. There is also moderate evidence that environmental factors such as access to high quality green space, safety and amenity, can influence participation in physical activity. Physical activity is strongly linked to health outcomes. A review of published research evidence linking access to green space, recreation and physical activity with health and wellbeing can be found in Volume 5: Appendix HE-003-000.

9.4.22 A review of the pathways through which the construction of the Proposed Scheme may impact on levels of access to green space and physical activity, and the potential for health effects, is documented in Volume 5: Appendix HE-001-002. This has identified the following impacts:

- impacts on PRoW, including temporary closures, diversions and loss of amenity, which may deter the use of these routes by walkers, cyclists and equestrians; and
- the presence of construction traffic, including HGVs, on the local road network, which may deter their use by walkers, cyclists and equestrians.

9.4.23 Impacts on access to green space for vulnerable users of Upper Moreton Farm will be affected by the construction of the Proposed Scheme are assessed under access to services, health and social care, above.

9.4.24 The Proposed Scheme will cross 16 PRoW, including seven bridleways, within the Colwich to Yarlet area. Temporary and permanent PRoW diversions will be required to enable its construction. The presence of construction works is likely to affect the amenity value of PRoW passing in the vicinity of the Proposed Scheme. Surveys undertaken to inform the traffic and transport assessment (Section 14, Traffic and transport) showed that there were fewer than 10 people a day recorded on most of the PRoW in the area. The towpath alongside the Trent and Mersey Canal (Colwich Footpath 63), which will be crossed by the Proposed Scheme, had 131 users observed during the survey day. Feedback from community consultation indicates that this route is highly valued by the local community. The construction of the Proposed Scheme will result in a reduction in amenity value of this PRoW and may adversely affect the wellbeing of existing users and potentially deter others from using a valued rural PRoW. The construction of the Proposed Scheme may detract from the appeal of other PRoW in its vicinity for recreational users.

9.4.25 Construction traffic will mainly utilise the site haul routes along the Proposed Scheme alignment. However, some construction traffic, including HGVs, will be present on local roads within the Colwich to Yarlet area. Section 14, Traffic and transport has identified the potential for construction traffic to obstruct or deter pedestrians, cyclists and equestrians on the following routes:

- the A51 Lichfield Road to the north and south of Great Haywood;
- Mill Lane to the south of the Proposed Scheme, east of Great Haywood;
- Hanyards Lane and Blackheath Lane, between Ingestre Park and Stafford;
- the A518 Weston Road, to the north and south of Staffordshire County Showground; and
- Marston Lane, to the south of the Proposed Scheme.

9.4.26 The presence of HGVs is likely to deter some non-motorised users from using the affected routes. In the case of recreational users, it is considered that alternative routes will be available. However, for those using these routes for active travel to work or to access shops and services, there is the possibility that people will choose instead to travel by car, temporarily reducing levels of physical activity and associated health and wellbeing benefits.

Social capital

9.4.27 The connections between individuals within communities, and the increased likelihood that arises through these networks for individuals to feel valued, to feel a sense of belonging, to have companionship and to support each other, is important for health and wellbeing. A measure of the effectiveness of these connections within communities is termed 'social capital' and is a recognised determinant of health. The Office for National Statistics defines social capital as follows:

> 'In general terms, social capital represents social connections and all the benefits they generate. Social capital is also associated with civic participation, civic-minded attitudes and values which are important for people to cooperate, such as tolerance or trust.'[125]

9.4.28 A review of published research evidence linking social capital with health and wellbeing can be found in Volume 5: Appendix HE-003-000. There is moderate evidence for a link between social capital and health and wellbeing outcomes. A decrease in social capital has the potential to reduce the beneficial effects on wellbeing that are gained through social contact and support, social participation, reciprocity and trust. 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.

9.4.29 A review of the pathways through which the construction of the Proposed Scheme may impact on levels of social capital, and the potential for health effects, is documented in Volume 5: Appendix HE-002-001 Health assessment matrix. This has identified temporary and permanent impacts including:

- permanent direct impacts on community facilities that support social capital; and

[125] Office for National Statistics- Measuring Social Capital: http://webarchive.nationalarchives.gov.uk/20160105160709/http://www.ons.gov.uk/ons/dcp171766_371693.pdf

- temporary impacts of the construction workforce.

9.4.30 The villages along the route support small, well established communities. Feedback from community consultation indicates that people's levels of trust in their communities[126] and community cohesion are strong. The assessment has identified potential wellbeing effects within these communities associated with the temporary construction workforce, which will be substantial relative to the size of these communities.

9.4.31 The majority of workers will reside at the Trent South embankment main compound, directly north of Great Haywood, which will provide temporary accommodation for up to 240 workers for approximately six years. During the day, the workforce will be present on construction sites and compounds throughout the area, including work sites and satellite compounds in the vicinity of the villages of Moreton, Great Haywood, Ingestre, Hopton, Marston and Yarlet. The daily average number of workers at each site will typically be around 20 to 30, and the duration of the works at each site will range from approximately one to four years. The presence of construction workers is likely to be very noticeable, with construction vehicles using local roads to access compounds, and workers using facilities within local villages, particularly Great Haywood.

9.4.32 It is well understood that the introduction of a temporary construction workforce into communities which have the characteristics identified above, has the potential to alter people's perceptions about their communities and reduce levels of trust. Such a reduction in social capital has the potential to affect wellbeing adversely, and may influence behaviours that are beneficial to wellbeing such as the use of community facilities.

9.4.33 The draft CoCP[127] includes a commitment to produce and implement a community engagement framework and provide appropriately experienced community relations personnel. HS2 Ltd will engage with local authorities and community representatives to identify measures aimed at fostering and maintaining good relationships between the workforce and local communities. Any measures identified will be included within the community engagement framework, as appropriate.

9.4.34 There is also a potential for the presence of the temporary workforce to have a beneficial effect on local communities through increased use of local services and opportunities for social interaction.

9.4.35 In the event that construction of the Proposed Scheme leads to the loss of Ingestre Park Golf Club clubhouse as a facility available for use for local community meetings, clubs and societies, the loss of that facility may lead to a reduction in social capital. In that event, and in the event that no suitable alternative facility is made available, the consequence may be an adverse effect on wellbeing in the local community.

[126] The ONS has developed a framework that covers four main aspects of social capital. One aspect is 'trust and co-operative norms'. This refers to how people feel about their neighbourhood, for example whether they feel people living in their local area can be trusted, are generally helpful, or get on. https://www.ons.gov.uk/peoplepopulationandcommunity/wellbeing/articles/socialcapitalacrosstheuk/2011to2012

[127] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

Other mitigation measures

9.4.36 In the event of any loss of a community facility, the options for mitigating significant community effects to be explored by HS2 Ltd 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.

9.4.37 HS2 Ltd will engage with local authorities and community representatives to identify measures aimed at fostering and maintaining good relationships between the workforce and local communities. Any measures identified will be included within the community engagement framework as appropriate.

9.4.38 HS2 Ltd will continue to engage with the owners and occupiers of Mayfield Children's Home and Upper Moreton Farm to develop mitigation measures that will reduce or avoid impacts on vulnerable users.

9.4.39 HS2 Ltd will continue to engage with local stakeholders to ensure that, in the event that the Ingestre Park Golf Club club house cannot continue to function in its present state, appropriate mitigation is put in place.

Cumulative effects

9.4.40 No cumulative health effects have been identified.

9.5 Effects arising from operation

Avoidance and mitigation measures

9.5.1 Adverse impacts on health determinants have been reduced insofar as reasonably practicable through mitigation measures incorporated into the design of the Proposed Scheme to reduce adverse effects on people. The mitigation measures incorporated into the design of the Proposed Scheme in the Colwich to Yarlet area include measures to integrate the Proposed Scheme into the landscape and providing visual and noise screening, including:

- noise fence barriers and bunds to provide acoustic screening for Moreton Farm, Great Haywood, Great Haywood Marina, Mill Lane, Hoo Mill Lane, Ingestre Park Golf Club, Ministry of Defence (MoD) Stafford, Mount Edge, Marston Lane, Yarlet Lane and A34 Stone Road; and
- earthworks to soften viaduct abutments, and landscape earthworks, including false cuttings, with planting to integrate the Proposed Scheme into the surrounding landscapes at Moreton, Ingestre, Hopton and Mount Edge, the B5066 Sandon Road and Marston Lane.

Assessment of impacts and effects

9.5.2 This section assesses the effects of the operation of the Proposed Scheme on the health and wellbeing of communities. Permanent construction impacts on health determinants resulting from the construction of the Proposed Scheme are assessed as construction impacts in Section 9.4.

Neighbourhood quality

9.5.3 Noise and visual impacts from passing trains will result in permanent operational impacts on neighbourhood quality in the communities in proximity to the Proposed Scheme, including Moreton, Great Haywood, Hopton and Marston. These operational impacts will be experienced alongside permanent construction impacts, including the presence of the railway infrastructure within the local landscape. Impacts on neighbourhood quality have the potential to affect the wellbeing of residents during the operational phase, by giving rise to negative feelings in relation to quality of life and the local environment.

9.5.4 At Moreton, the widening of Bishton Lane will permanently alter its character. The Moreton North embankment and Great Haywood viaduct structures and passing trains will be visible from Bishton Lane and other local PRoW, and from residential properties in elevated positions such as Moreton Cottages. Intermittent train noise will be noticeable from these locations. Residents living in Moreton are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, both in diminishing the amenity of the hamlet and in reducing the sense of its rural character and tranquillity.

9.5.5 Passing trains on the Great Haywood viaduct to the north of Great Haywood will be visible from street level and from the gardens of approximately 10 dwellings on Tolldish Lane, and six dwellings on Hoo Mill Lane, as well as from the A51 Lichfield Road and roadside footway approaching Great Haywood from the north, Hoo Mill Basin and the canal towpath recreational route. Intermittent train noise will be noticeable from Tolldish Lane, Hoo Mill Lane, Hoo Mill Basin and the canal towpath. Residents on Tolldish Lane and Hoo Mill Lane are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, in diminishing the amenity of gardens and outdoor areas.

9.5.6 Passing trains on the embankment will be visible from approximately six properties at Park Farm, near Staffordshire County Showground, and train noise will reduce amenity in the gardens of these properties. Residents in Park Farm may experience these features as changing the quality of their neighbourhood adversely.

9.5.7 Hopton cutting and passing trains will be visible from the gardens of properties along the southern edge of Hopton village and the north-east side of Mount Edge, the seating area in centre of the village, and intermittently from street level throughout the village. Mitigation planting will shorten views from elevated areas. Outdoor areas throughout Hopton and in north-eastern parts of Mount Edge will experience reduced amenity value as a result of train noise. Residents living in Hopton are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse, both in diminishing the amenity of the village and in reducing the sense of its rural character and tranquility.

9.5.8 Long distance views from street level and from private gardens of properties on the north side of Yarlet Lane will be lost due to presence of the landscape bund, and outdoor amenity will be impacted by intermittent noise from passing trains. The character of Marston village, including the setting of the church and pub will be affected by views of the embankment and mitigation planting, replacing existing long views. Residents living in Marston are likely to experience these features of the Proposed Scheme as changing the quality of their neighbourhood and to regard that change as adverse.

9.5.9 It is considered likely that the effects on wellbeing will lessen over time, as mitigation planting becomes established and as communities become accustomed to the presence of the Proposed Scheme.

9.5.10 The quality of the environment around Mayfield Children's Home in Moreton will be severely impacted by noise and visual impacts due to permanent loss of land, the presence of the Proposed Scheme infrastructure and train noise. Individuals with ASD can be hypersensitive to noise and sometimes specific frequencies of sound. Sounds can become magnified, distorted or muddled and affected individuals may struggle to cut-out background noises, which can lead to difficulties concentrating. It is considered likely that the impacts of the Proposed Scheme will affect the health and wellbeing of children at the home adversely and that, as a result, the suitability of the site for the purpose of housing vulnerable children will be adversely affected. HS2 Ltd will continue to engage with the owners and occupiers of the home to develop mitigation measures that will reduce or avoid impacts on vulnerable users.

Access to services, health and social care

9.5.11 Services provided at Upper Moreton Farm will be permanently impacted by loss of land and changes to the noise and visual environment in outdoor areas, affecting the farm's suitability for therapeutic activities for vulnerable people, which are dependent upon its tranquil, rural setting.

9.5.12 Any significant reduction in the range and quality of services available at the farm may adversely affect the health and wellbeing of vulnerable users, such as those with mental health problems, multiple learning difficulties, ASD and emotional difficulties, by limiting opportunities for therapeutic activities. HS2 Ltd will continue to engage with the owners and occupiers of the farm to develop mitigation measures that will reduce or avoid impacts on vulnerable users.

Other mitigation measures

9.5.13 HS2 Ltd will continue to engage with the owners and occupiers of Upper Moreton Farm and Mayfield Children's Home to develop mitigation measures that will reduce or avoid impacts on vulnerable users.

Cumulative effects

9.5.14 No cumulative health effects have been identified.

Monitoring

9.5.15 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

9.5.16 No specific monitoring of health effects during the operation of the Proposed Scheme are proposed.

10 Land quality

10.1 Introduction

10.1.1 This section of the report presents the baseline conditions that exist along the Proposed Scheme in the Colwich to Yarlet area in relation to land quality, and reports the likely impacts and significant effects resulting from construction and operation of the Proposed Scheme. Consideration is given to land that potentially contains contamination and land that has special geological significance, from a scientific, historical, mineral exploitation or mineral resources point of view including geological sites of special scientific interest (SSSI) and local geological sites (LGS), 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 residual significant effects are summarised.

10.1.2 Engagement has been undertaken with the British Geological Survey (BGS), Staffordshire County Council (SCC), Stafford Borough Council (SBC), Staffordshire County Showground, the Environment Agency, the Food and Environment Research Agency and the Animal and Plant Health Agency. The purpose of this engagement has been to discuss the Proposed Scheme and potential effects, and obtain relevant baseline information.

10.1.3 Details of baseline information, conceptual site models (CSM) and risk assessments are outlined in Volume 5: Appendix LQ-001-002 and presented in presented in Maps LQ-01-105b-L1 to LQ-01-109a (Volume 5: Land Quality Map Book).

10.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

10.1.5 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding groundwater resources are addressed in Section 15, Water resources and flood risk. Issues regarding the disposal of waste materials, including contaminated soils, are addressed in Volume 3, Route-wide effects (Section 15).

10.2 Scope, assumptions and limitations

10.2.1 The scope, assumptions and limitations for the land quality assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)[128], and Volume 5: Appendix LQ-001-002.

10.2.2 In accordance with the SMR, a risk based approach has been undertaken to identify contamination that may have an impact upon the construction of the Proposed Scheme. To support this, a desk based assessment has been undertaken for the study area, defined as the land required for the Proposed Scheme plus a 250m buffer from the edge of proposed construction activities. In the case of groundwater this is increased to 1km.

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

10.2.3 New and diverted utilities will be laid in the boundaries of existing highways within normal road construction layers and natural soils below or land close by. These have been considered in the context of the CSM approach, and the lack of contact with nearby potentially contaminated sites, and the absence of sensitive receptors within the roadways reduces the risk of an impact occurring to very low levels. The impact of laying these new and diverted utilities has therefore been scoped out of the assessment as they are unlikely to cause any significant land quality effects.

10.2.4 Potentially contaminated areas of land have been identified that could affect, or be affected by, the construction of the Proposed Scheme (e.g. contaminated soils may need to be removed or construction may alter existing contamination pathways). Each of these areas has been studied to evaluate the scale of potential impacts caused by existing contamination (if present) and what needs to be done to avoid significant consequences to people and the wider environment.

10.2.5 The location of the Proposed Scheme was viewed from points of public access initially. In addition, visits to some key sites have been undertaken to verify desktop information.

10.2.6 A CSM approach has been used to provide an understanding of the types of contaminants that may be present, the likely sources and/or pathways by which contamination can spread and the potential receptors (i.e. people and the wider environment) that could be affected. It indicates the types of impacts that existing contamination may be having at present and may have during and after construction.

10.2.7 The minerals assessment is based upon the minerals identified on published mineral plans and existing planning or licensed areas. Any inference of the presence of minerals provided by geological maps/reports is excluded (except where these are covered by the Minerals Local Plan (MLP)).

10.2.8 The geo-conservation assessment is based upon local geological trust records.

10.3 Environmental baseline

Existing baseline

10.3.1 Baseline data has been collected from a range of sources including Ordnance Survey mapping, the British Geological Survey, Coal Authority, SBC, SCC, Public Health England, the Environment Agency, Natural England, Food and Environment Research Agency and the Animal and Plant Health Agency records, as well as web sources such as local geological trusts.

10.3.2 Unless otherwise stated, all features described in this section are presented in Maps LQ-01-105b-L1 to LQ-01-109a (Volume 5: Land Quality Map Book).

Geology

10.3.3 This section describes the underlying ground conditions within the Colwich to Yarlet area. Recent changes in lithostratigraphic classifications by the British Geological Survey have been incorporated where appropriate[129].

10.3.4 Table 18 provides a summary of the superficial and bedrock units underlying the Proposed Scheme from Colwich to Yarlet

Table 18: Summary of the superficial and bedrock units underlying the Proposed Scheme from Colwich to Yarlet

Geology	Distribution	Formation description	Aquifer classification
Superficial			
Peat	Approximately 1km south-west of Hopton and elongated patches to the south of the route of the Proposed Scheme at Marston	Organic rich clay or humic deposits	Unproductive
Alluvium	Along the River Trent and tributaries	Clay, silt, sand and gravel	Secondary A
River Terrace Deposits	Along the River Trent valley	Sand and gravel	Secondary A
Glaciofluvial Sheet Deposits	Around Tixall, following the unnamed watercourse; in the vicinity of Stafford and Hopton; and along the Trent Valley near Yarlet and Salt	Sand and gravel	Secondary A
Glacial Till	Small patches along the route of the Proposed Scheme	Sandy silty clay	Secondary (Undifferentiated)
Bedrock[130]			
Mercia Mudstone Group – Mudstone	Along the majority of the route of the Proposed Scheme	Red, less commonly green-grey mudstone and siltstone with some halite-bearing units, and presence of sandstone	Secondary B
Mercia Mudstone Group – Stafford Halite Member	To the north of the route of the Proposed Scheme from Yarlet to Sandon at the northern end of the Colwich to Yarlet area	Discontinuous lenses and beds of halite mixed with mudstone	Secondary B
Sherwood Sandstone Group - Helsby Sandstone Formation (Bromsgrove Sandstone Formation)	Extends to the north and south of the route of the Proposed Scheme, approximately between Hopton and Lambert's Coppice. Mudstone is present to the north of the route of the Proposed Scheme around Hopton Heath and to the south of the route at Lower Hanyards	Red, brown and grey sandstone, commonly pebbly or conglomeratic at the bases of beds, interbedded with red and brown siltstones and mudstones	Principal (sandstone) Secondary B (mudstone)
Sherwood Sandstone Group -Chester Formation (Kidderminster Formation)	To the south of Hopton and around Salt	Pebble conglomerate in a sandy matrix	Principal

[129] 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

[130] Names in brackets refer to previous naming convention.

Geology	Distribution	Formation description	Aquifer classification
Pennine Coal Measures Group	Present beneath the entire study area, but at depths ranging from 300m to 500m	Alternating sandstone, grey siltstone and grey mudstone with frequent coal seams and seatearth horizons	Not applicable

Made ground

10.3.5 Made ground is a term used to denote man-made deposits such as landfill, spoil heaps or earthworks associated with construction or ground improvement. Such deposits may be poorly mapped and are often very variable in composition. Minor deposits of made ground may be encountered within this area, for example where ponds, sand or marl pits have been backfilled. There is evidence of historical and authorised landfilling within the area, which may comprise more significant deposits of made ground.

10.3.6 Farm burial and pyre sites associated with the 2001 outbreak of foot and mouth disease are known to be present within the study area. In addition, older unrecorded sites may be present from the 1967 outbreak. Similarly, records and anecdotal reports of anthrax-infected cattle burials have also been found, generally relating to burials over 50 to 100 years ago. In all cases, the records do not provide an exact location for the burial or pyre sites and other, unrecorded sites are likely to be present.

Superficial geology

10.3.7 An area of peat is located approximately 1km south-west of Hopton. Areas of peat also occur to the south of where the route of the Proposed Scheme will be located at Marston.

10.3.8 Alluvial deposits variably comprising silty clay, silt, sand, peat and gravel occur along the courses of streams and rivers specifically the River Trent near Ingestre and its tributaries.

10.3.9 River Terrace Deposits comprising sand and gravel are present, associated with the River Trent near Ingestre.

10.3.10 Glaciofluvial Sheet Deposits comprising sand and gravel are present around Tixall, in the vicinity of Stafford and Hopton, and along the River Trent valley, near Yarlet and Salt. Some of the sands and gravels within the area are currently being worked and have been worked for construction materials historically.

10.3.11 Glacial Till is present to the east of Great Haywood, across a plateau to the east of Hopton and to the north of the study area. These deposits comprise sandy silty clay, which historically have been extracted from marl pits for use locally as a soil improver for agriculture.

Bedrock geology

10.3.12 The bedrock geology in this study area comprises the Mercia Mudstone Group and the Sherwood Sandstone Group.

10.3.13 The majority of the Proposed Scheme within the study area is underlain by the Mercia Mudstone Group which is present from the southern end of the area to Lambert's

Coppice. The Mercia Mudstone Group also continues west of Hopton to the north of the Proposed Scheme. The Hopton fault runs north-south through the centre of Hopton and forms an abrupt divide between the Mercia Mudstone Group to the west and the Helsby Sandstone Formation (part of the Sherwood Sandstone Group) to the east. The Mercia Mudstone Group is typically described as mudstone and siltstone with some halite-bearing units and sandstone.

10.3.14 West of Lambert's Coppice, the geology becomes faulted and rocks of the Helsby Sandstone Formation are present beneath the superficial deposits. To the south of Hopton and in the area of Salt and further north, the near surface geology is the Chester Formation (part of the Sherwood Sandstone Group). Rocks of the Sherwood Sandstone Group typically comprise red, brown and grey sandstone and conglomerate interbedded with red and brown siltstones and mudstones.

10.3.15 At the northern end of the study area, from Yarlet northwards for the remaining 750m of the Colwich to Yarlet area, the Stafford Halite Member of the Mercia Mudstone Group is present. The Stafford Halite comprises mudstone and halite stone. Halite stone is a sedimentary rock comprising greater than 50% rock salt.

Radon

10.3.16 Radon is a radioactive gas formed by the radioactive decay of naturally occurring uranium in rocks and soils. Two sections of the Proposed Scheme in this study area lie within a radon affected area, as defined on Public Health England's UK Radon online maps[131]:

- the area of the Proposed Scheme immediately north of Great Haywood; and
- the section of the Proposed Scheme from Staffordshire County Showground to Hopton Pools.

10.3.17 In both of these areas the maps show that between 1% and 3% of homes have radon levels above the action level of 200 becquerels per cubic metre of air (Bq/m3) for residential properties. For the remainder of the area between Colwich and Yarlet, less than 1% of homes are indicated to be above the radon action level.

Groundwater

10.3.18 Five categories of aquifer have been identified within the study area, as defined by the Environment Agency.

- the Helsby Formation of the Sherwood Sandstone Group is designated as a Principal aquifer, although one area of mainly mudstone in this formation is a Secondary B aquifer;
- the Mercia Mudstone Group underlying the majority of the study area and the Stafford Halite Member at the northern end of the study area have been designated as Secondary B aquifers;

[131] Public Health England; *UK Maps of Radon*. Available online at: www.ukradon.org/information/ukmaps

- River Terrace Deposits, Glaciofluvial Sheet Deposits and Alluvium are classified as Secondary A aquifers; and
- the Glacial Till is designated as a Secondary undifferentiated aquifer; and
- the Peat is classified as an Unproductive aquifer.

10.3.19 The Environment Agency reports that there are three licensed groundwater abstractions located within 1km of the Proposed Scheme, at Moreton Grange Farm, Ingestre Park Golf Club and Staffordshire County Showground.

10.3.20 According to SBC records, there are four private groundwater abstractions that do not require a permit registered within the study area. These are at Upper Hanyards Farm, Bishton Farm, Bishton Lane Farm and at a property on Bishton Lane located to the west of Bishton Hall Farm. Due to the absence of nearby surface watercourses, the water from these abstractions 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 and not the location of the abstraction borehole. It should be noted that all abstractions that are used directly or indirectly for human consumption are by default provided with source protection zones (SPZ)[132]. In such cases the abstraction point qualifies for a default 10m radius source protection zone 1 and a default 250m radius for source protection zone 2. There is no default zone 3 for total catchment with respect to this type of abstraction.

10.3.21 No licensed public water supply abstractions have been identified within the study area. One total catchment SPZ3 is located approximately 1km south-west of the route of the Proposed Scheme at Great Haywood associated with public water supply sources.

10.3.22 At the northern end of the Proposed Scheme in this area, the interaction of groundwater with halite deposits within the Stafford Halite Member has resulted in the natural dissolution of the salt. This gives rise to brine where the saliferous deposits are close to the surface.

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

Surface water

10.3.24 The River Trent is the most significant watercourse within the study area and will be crossed by the route of the Proposed Scheme, near Ingestre. The route will also cross the Trent and Mersey Canal, close to the location where it will cross the River Trent, approximately 70m north of Great Haywood Marina.

10.3.25 Moreton Brook and a number of unnamed streams, tributaries, drains, ponds and culverts are also located within the study area.

10.3.26 There are no licensed surface water abstractions located within the study area.

[132] 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.

10.3.27 Further information on surface waters in the Colwich to Yarlet area is provided in Section 15, Water resources and flood risk.

Current and historical land use

10.3.28 Current potentially contaminative land uses within the study area include the Ministry of Defence (MoD) Stafford site at Within Lane, one active garage, two sewage filter beds, Pasturefields Enterprise Park, a British Pipeline Agency (BPA) pipeline, two active railway lines together with several farms.

10.3.29 Historical land uses identified within the study area with the potential to have caused contamination include 13 historical landfill sites as shown in Table 19, two historical smithies, one historical garage and several small infilled extraction pits and ponds. The infilled pits and ponds may have been filled with a variety of waste materials, but have not been licensed.

Table 19: Landfill sites located in the study area

Name and Area Reference[133]	**Location**	**Description**[134]
Far Coley Farm Landfill (LW Skip Hire), Coley Lane, landfill 2-192	The landfill is located approximately 270m west of Far Coley Farm, Volume 5: Map LQ-01-105b, 2-192	The Environment Agency records that the landfill was licensed in December 1994 to accept commercial waste. First deposit of waste occurred in May 1995 and last input was in February 1996.The licence was surrendered in December 2000. The Environment Agency describes the waste as pottery moulds, fired earthenware, uncontaminated clay and soils, bricks and hardcore.
Sytch Lane Landfill Site, Tolldish Lane, Great Haywood 2-29, CA2-30	Located to the immediate east of Tolldish Lane. Environment Agency records place the landfill approximately 200m to the south-west of Tolldish, Volume 5: Map LQ-01-106, 2-29. SCC records place the landfill at a point approximately 350m to the south-west of Tolldish, Volume 5: Map LQ-01-106, 2-30.	Two locations have been provided for this landfill site. Both locations have been assessed to ensure that the correct location is considered within the assessment. Environment Agency records state that the landfill received household waste in the 1960s.
Mountford - Tixall Landfill Site, Tixall, Stafford 2-42	Located to the immediate east of Tixall Road, Volume 5: Map LQ-01-106, 2-42.	Environment Agency records state that the landfill was licensed in December 1992. First deposit of waste was in March 1994 and last input was in September 1995, although the surrender information stated last input of waste was in 1997. The licence was surrendered in January 2006. Additional information provided by SCC records the waste as inert subsoils and soils only.
Madders - Lower Hanyards Farm Landfill Site, Hanyards Lane 2-60	Located to the immediate north-west of Hanyards Lane, between Upper and Lower Hanyards farms, Volume 5: Map LQ-01-107, 2-60.	Environment Agency records state that the landfill was licenced in December 1992. First deposit of waste was in December 1992 and last input was in December 1996. The licence was surrendered in August 2005. Information provided by SCC records the waste as comprising dry inert rubble, hardcore, bricks, soil and subsoil.

[133] The area reference is the unique identifying number for the site, shown on the Volume 5: Land Quality Map Book.
[134] Information on waste types was obtained from the Environment Agency by email on 16th May 2016 and from SCC online planning records.

Name and Area Reference[133]	Location	Description[134]
Staffordshire County Showground Landfill (Elmstar Plant) 2-69	Located in the south-western corner of the Staffordshire County Showground site, Volume 5: Map LQ-01-107, 2-69.	Environment Agency records state that the landfill was licensed in June 1986 for the deposit of inert and industrial wastes. The date of first deposit of waste is unknown, but the last input was in June 1989. The licence was surrendered in October 1991. The Environment Agency records the waste as construction, excavation and demolition materials.
Challinor – Within Lane Landfill Site, Hopton 2-219	Located to the south of Within Lane, Volume 5: Map LQ-01-107, 2-219.	Environment Agency records state that the landfill was permitted to accept industrial and inert wastes. A licence was issued in May 1977. First deposit of waste occurred in December 1969[135] and last input was in December 1978. The licence was surrendered in September 1992. The Environment Agency records the waste as builder's waste, incinerator residues, cured plastic waste, timber offcuts, cardboard, subsoil, topsoil and hardcore.
Stafford Borough Council – Hopton Railway Cutting Landfill, Within Lane, Hopton 2-97	Located to the south of Within Lane and the east of Sandon Road, Hopton, Volume 5: Map LQ-01-108, 2-97.	Environment Agency records state that the landfill is operated by SBC and was licensed to accept household, commercial and industrial waste in April 1984, although a record also exists which dates the landfill as 'pre-1974'. There is no record of licence surrender but the status of this landfill is 'closed'. Routine gas monitoring is carried out annually by the Environment Agency within the site. Gas venting points are present along the centre line of the landfill, although these are not functioning, and gas monitoring points at the outer edges.
Kents Barn Farm No. 1 Landfill (H Nickolls and Son (Milford) Ltd), Sandon Road, Hopton 2-188	Located approximately 150m north west of Kents Barn Farm, Volume 5: Map LQ-01-108, 2-188.	Environment Agency records state that the landfill was licensed in July 1982 to accept industrial and commercial wastes. First deposit of waste occurred in July 1982 and last input was in July 1984. The licence was surrendered in September 1992. The Environment Agency describes the wastes as construction and farm waste.
Kents Barn Farm No. 2 Landfill (H Nickolls and Son (Milford) Ltd), Sandon Road, Hopton 2-108	Located off an access track leading from Kents Barn Farm, Volume 5: Map LQ-01-108, 2-108.	Environment Agency records state that the landfill was licensed in September 1983 to accept inert and industrial wastes. First deposit of waste occurred in September 1983 and last input was in January 1985. The licence was surrendered in September 1992. The Environment Agency describes the wastes as construction and farm waste.
Kents Barn Farm No. 3 Landfill, Hopton 2-106	Located approximately 380m north-east of Kents Barn Farm, Volume 5: Map LQ-01-108, 2-106.	Environment Agency records state that the landfill was licensed in October 1984 to accept inert, industrial and commercial wastes. First deposit of waste occurred in October 1984 and last input was in March 1987. The licence was surrendered in September 1992.

[135] The Control of Pollution Act 1974 required all landfills to be licensed.

Name and Area Reference[133]	Location	Description[134]
		The Environment Agency describes the wastes as rubble, hardcore and excavated materials.
New Farm Landfill, Yarlet Lane, Marston 2-146	Located on the southern side of Yarlet Lane, Marston, Volume 5: Map LQ-01-108, 2-146	Environment Agency records state that the landfill received industrial waste, described as highways maintenance waste. The first input of waste was in December 1979 and the last input in December 1980.
Hopton Farm Local Authority Recorded Landfill, Hopton 2-209	Located approximately 140m north of B5066 Sandon Road, Volume 5: Map LQ-01-108, 2-209	Environment Agency records state that the landfill first received waste in January 1966 and the last input of waste was in December 1968. No further details are available.
Mill House Landfill (JW Hunt), Mill Lane, Great Haywood, Stafford 2-220	Located approximately 350m west of Great Haywood, Volume 5: Map LQ-01-106, 2-220.	Environment Agency records state that the landfill was licensed in October 1984 to accept inert and industrial wastes. The first deposit of waste occurred in October 1984 and last input was in September 1990. The Environment Agency describes the waste as demolition and construction waste.

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

Other regulatory data

10.3.31 The regulatory data reviewed included pollution incidents (major, significant and minor categories), radioactive and hazardous substances consents and environmental permits (previously landfill, integrated pollution control and integrated pollution prevention and control licences). There were no major, four significant and 16 minor incidents reported over a 17 year period between 1997 and 2014.

10.3.32 Of the four significant (Category 2) pollution incidents recorded, three related to the pollution of surface waters, with two separate incidents reported in 2014 affecting Tixall Park pool in Tixall, and one incident reported in 2009 relating to a pond between Yarlet and Marston. The fourth significant pollution incident related to the pollution of a public water supply as a result of a fire involving aluminium dross at Pasturefields Enterprise Park, in 1998.

10.3.33 There is one nationally significant ecological designation located within the study area, Pasturefields Special Area of Conservation (SAC) and SSSI, an area of inland salt marsh.

10.3.34 Two licensed discharges to surface water sources have been identified within the study area, the first at Great Haywood from a sewage pumping station and the second at Hopton.

Mining/mineral resources

10.3.35 SCC is responsible for the overall mineral and waste local plans for the county. The MLP for Staffordshire (2015 to 2030)[136] was adopted in February 2017 and sets out the SCC policies aimed at controlling mineral related developments within Staffordshire up to the year 2030.

10.3.36 There are no proposed MLP Allocations within the study area.

10.3.37 Data provided by SCC indicates that there are two proposed mineral safeguarding areas covering large parts of the study area; one is for superficial sand and gravel, which includes land around Moreton, Ingestre, Hopton and Colwich. The second is for bedrock sand and includes land around Hopton and Staffordshire County Showground.

10.3.38 There are no mineral sites with permitted reserves within the study area.

10.3.39 There are no current licences for coal or coal bed methane exploitation, and no gas exploration licences within the study area.

10.3.40 Coal seams of the Pennine Coal Measures Group are present at depth beneath the study area, and the available records from the Coal Authority show that the route of the Proposed Scheme from the boundary of the Colwich to Yarlet area to the Hopton Fault overlies an extension of the South Staffordshire Coalfield. The MLP identifies the entire study area as a potential source of coal bed methane gas (CBM). While the MLP states that there has been recent interest in CBM across Staffordshire to date, interest has mainly been in relation to the North Staffordshire Coalfield.

10.3.41 The Stafford Halite Formation, which occurs within the study area, has been exploited commercially for brine production in the past. This led to subsidence problems, which occurred outside the study area to the south-west[137]. A broader solution zone is present parallel to the line of the Hopton Fault. However, a British Geological Survey plan dated 1995[138] stated that the Halite deposits 'are unlikely to be of future economic importance'.

10.3.42 The Staffordshire and Stoke-on-Trent Minerals Local Plan 1994-2006[139] stated that 'there is no evidence to suggest that there is any commercial interest in further brine pumping in the Plan area'. The MLP for 2015-2030 does not make reference to brine pumping or halite as a mineral resource.

Geo-conservation resources

10.3.43 No geological SSSI or LGS sites have been identified within the study area. Therefore, no assessment of geo-conservation resources has been carried out.

[136] https://apps2.staffordshire.gov.uk/scc/TrimDocProvider/?ID=002/20/20/0503905
[137] Arup Geotechnics, (1990), *Review of Mining Instability in Great Britain for the Department of the Environment. Case Study Report: Stafford Brine Pumping (Staffordshire). Volume 3/vi,* Department of the Environment.
[138] British Geological Survey (1995*) Staffordshire (excluding the Peak District National Park) A Summary of Mineral Resource Information for Development Plans. Mineral Resources (other than sand and gravel).* Plan at 1:100,000 scale.
[139] Adopted in December 1999, now withdrawn following the adoption of the Minerals Local Plan for Staffordshire (2015-2030).

Receptors

10.3.44 The sensitive receptors that have been identified within this study area are summarised in Table 20. A definition of receptor sensitivity is given in the SMR.

Table 20: Summary of sensitive receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents at existing properties, schools and study centres	High
		Workers and visitors at nearby facilities	Moderate
		Public using PRoW	Low
	Groundwater	Principal aquifer	High
		Secondary A aquifers	Moderate
		Secondary B aquifers and undifferentiated aquifers	Low to moderate
		Unproductive aquifers	Low
	Surface waters	River Trent, Moreton Brook, tributaries	Moderate
		Trent and Mersey Canal	Low
	Built environment	Underground structures and buried services	Low
		Buildings and property	Low to high
	Natural environment	Pasturefields SAC and SSSI	High
Impacts on mining/mineral and petroleum (gas) sites (severance and sterilisation)	Mining/mineral sites	Sand and gravel, bedrock sand mineral safeguarding areas	Medium
		Coal deposits, including coal bed methane	Low
		Mineral resource of halite (salt)	Low

Future baseline

Construction (2020)

10.3.45 Volume 5: Appendix CT-004-000 provides details of committed developments in the Colwich to Yarlet area that are assumed to have been implemented by 2020.

10.3.46 The committed development that materially affects the baseline conditions for land quality in this area and forms part of the future baseline assessment of the effects during construction is listed in Table 21.

Table 21: Committed development relevant to land quality

Map Book Reference[140]	Planning Reference	Description
CA2/41	Policy Stafford 2 - North of Stafford - Housing	Allocation for two housing sites for around 3,100 dwellings in total.

Operation (2027)

10.3.47 Volume 5: Appendix CT-004-000 provides details of committed developments in the Colwich to Yarlet area that are assumed to have been implemented by 2027.

10.3.48 There are no further committed developments which will affect the baseline conditions during operation of the Proposed Scheme.

10.4 Effects arising during construction

Avoidance and mitigation measures

10.4.1 The construction assessment takes into account the mitigation measures described in the draft Code of Construction Practice[141] (CoCP). The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme and includes requirements to ensure the effective management and control of work in contaminated areas.

10.4.2 The requirements in the draft CoCP in relation to work in contaminated areas will ensure the effective management and control of the work. These requirements include:

- methods to control noise, waste, dust, odour, gases and vapours (Sections 5, 7, 13 and 15);
- methods to control spillage and prevent contamination of adjacent areas (Section 5);
- the management of human exposure for both construction workers and people living and working nearby (Section 11);
- methods for the storage and handling of excavated materials (both contaminated and uncontaminated) (Sections 7 and 15);
- management of any unexpected contamination found during construction (Section 11);
- a post-remediation permit to work system (Section 11);
- storage requirements for hazardous substances such as oil (Section 16);
- traffic management to ensure that there is a network of designated site haul routes to reduce compaction/degradation of soils (Section 7);

[140] Volume 5 Planning Data/Committed Development Map Book: Maps CT- Maps CT-13-105b to CT-13-109a-R1.
[141] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

- methods to monitor and manage flood risk and other extreme weather events, where reasonably practicable, that may affect land quality during construction (Section 5 and 16); and
- methods to manage discovery of unknown animal burial pits (Section 6).

10.4.3 The draft CoCP will require that prior to and during construction, a programme of further detailed investigations, which may include both desk based and site based work, takes place in order to confirm the full extent of areas of contamination. It also requires a risk assessment to be undertaken to determine what, if any, site specific remediation measures are required to allow the Proposed Scheme to be constructed safely and to prevent harmful future migration of contaminants. The investigation and assessment of potentially contaminated sites will be undertaken in accordance with Environment Agency CLR11[142] and British Standards BS10175[143] and BS8576[144].

10.4.4 Where significant contamination is encountered, a remedial options appraisal will be undertaken to define the most appropriate remediation techniques. Where appropriate, this appraisal will be undertaken based on multi-criteria attribute analysis that considers environmental, resource, social and economic factors in line with the framework set out by the Sustainable Remediation Forum UK[145]. The preferred option will then be developed into a remediation strategy.

10.4.5 Contaminated soils excavated within the site, where reasonably practicable, will be treated to remove or render contamination inactive and reused within the Proposed Scheme where needed and suitable for use. Treatment techniques could include stabilisation, soil washing and bio-remediation. Contaminated soil removed off-site will be taken to a soil treatment facility, another construction site (for treatment, as necessary, and reuse) or to an appropriately permitted landfill.

Assessment of impacts and effects

10.4.6 Construction of the Proposed Scheme in this area will require earthworks, utility diversions, deep foundations and other activities, including the construction of the various viaducts and road infrastructure works. These aspects of the Proposed Scheme, along with other construction features, are shown on the Map Series CT-05 in Volume 2: CA2 Map Book.

Land contamination

10.4.7 In line with the assessment methodology, as set out in the SMR, an initial screening process has been undertaken to identify areas of current or historical contaminative use within the study area and to consider which of these areas might pose contaminative risks for the Proposed Scheme. Sites that present a low risk have not been taken further in the assessment. Any moderate to high risk sites have been taken forward to more detailed risk assessments, in which the potential risks are assessed more fully. The majority of the areas which have undergone the more detailed risk assessments are historical landfills, MoD land, farms and infilled

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

pits/ponds. All areas assessed are shown on Maps LQ-01-105b-L1 to LQ-01-109a (Volume 5: Land Quality Map Book) and those considered as potentially posing a risk to the Proposed Scheme are labelled with a reference number.

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

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

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

10.4.10 A simple summary of the baseline CSM is provided in Table 22. A more detailed assessment of baseline risk is provided in Volume 5: Appendix LQ-001-002. The potential baseline risks presented are those before any mitigation is applied. The assessed baseline risk is based on the information available at the time of the assessment. Where limited information is available, the assessment is based on precautionary, worst case assumptions and may, therefore, report a higher risk than that which actually exists. A screening assessment of the effects of contamination has been completed by comparing the detailed CSM developed for potential contaminated areas at baseline with construction and post-construction stages.

Table 22: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area ref[146]	Area name	Human health risk	Ground water risk	Surface water risk	Buildings risk
2-107, 2-162, 2-176, 2-171, 2-168, 2-5, 2-23	Kents Barn Farm, Staffordshire County Council Holding No.33, Yarlet Bank Farm, Hilltop Farm, Grove Farm, Moreton Grange Farm, Tithebarn Farm. Farms grouped for purposes of assessment, all located over a Secondary B aquifer	Very low to moderate	Moderate/low	Moderate/low	Very low to moderate/low
2-37	Sewage filter bed, Tolldish Lane, Great Haywood	Very low to low	Moderate/low	Moderate/low	Low to moderate/low
2-39 and 2-245	Railway embankments (active)	Very low to moderate/low	Moderate/low	Moderate/low	Very low to low
2-41	Infilled ponds at Hoo Mill	Low to moderate	Moderate	Moderate	Low to moderate

[146] Each potentially contaminated site is allocated a unique reference number (See Volume 5: Appendix LQ-001-002).

Area ref[146]	Area name	Human health risk	Ground water risk	Surface water risk	Buildings risk
2-42 and 2-220	Mountford - Tixall Landfill Site and Mill House landfill site (JW Hunt)	Very low to moderate	Moderate/low	Moderate/low	Low to moderate/low
2-71, 2-55, 2-83, 2-85, 2-76, 2-213	Brick House Farm, Upper Hanyards Farm, Mount Farm, Lowerbridge Farm, Lowerhouse Farm and Canalside Farm all located over a Principal aquifer	Moderate/low to moderate	High	Moderate	Very low to moderate/low
2-56	Tank within farmyard at Upper Hanyards Farm	Very low to moderate	High	Moderate/low	Low to moderate/low
2- 60	Madders - Lower Hanyards Farm Landfill Site, Hanyards Lane	Very low to moderate	Moderate/low	Moderate/low	Low to moderate/low
2-65 and 2-66	Tanks at Staffordshire County Showground	Very low to moderate/low	Moderate	Low	Very low
2-69	Staffordshire County Showground landfill (Elmstar Plant)	Very low to moderate	High	Low	Very low to moderate/low
2-70 and 2-77	Smithies, Hopton	Very low to moderate/low	Low	Very low	Very low to low
2-89	MoD Stafford Depot off Within Lane, Hopton	Low to moderate/low	Moderate/low	Very low	Very low
2-94	Infilled marl pit at Hopton Farm	Low to moderate	Low	Low	Low to moderate
2-95	Filter bed/tank, Hopton	Very low to low	Low	Low	Very low to moderate/low
2-96	Vehicle servicing garage, Hopton	Very low to moderate/low	Low	Very low	Low to moderate/low
2-97	Stafford Borough Council– Hopton Railway Cutting landfill, Within Lane, Hopton	Very low to moderate	Moderate/low	Very low	Low to moderate
2-106	Kents Barn Farm No. 3 landfill, Hopton	Low to moderate/low	Moderate/low	Low	Very low to moderate/low
2-108	Kents Barn Farm No. 2 landfill (H Nickolls and Son (Milford) Ltd), Sandon Road, Hopton, landfill	Low to moderate	Moderate/low	Low	Low to moderate
2-164	Yarlet Bank former garage/petrol station	Very low to moderate/low	Very low	Very low	Very low to moderate/low
2-179	Historical tank within farmland, Yarlet	Very low to moderate/low	Moderate/low	Moderate/low	Very low
2-189	Dismantled railway, Hopton	Very low to moderate	Moderate/low	Moderate/low	Very low

Area ref[146]	Area name	Human health risk	Ground water risk	Surface water risk	Buildings risk
2-208	Potential anthrax infected cattle burial site, Hopton	Very low to moderate	Moderate/low	Moderate/low	N/A
2-219	Challinor - Within Lane Landfill Site, Hopton	Very low to moderate	Moderate	Moderate/low	Moderate/low to moderate
2-221	BPA Pipeline, Marston to Bishton	Very low to moderate/low	Moderate	Moderate	Low to moderate
2-254, 2-255, 2-256, 2-249, 2-248, 2-253	Tanks, factory, pumping station and depots on Pasturefields Enterprise Park	Very low to low	Moderate/low	Moderate/low	Very low to low

Temporary effects

10.4.11 In order to identify potential temporary effects, the baseline and construction CSM have been compared to determine the change in level of risk at receptors during the construction stage, and thus to define the level of effect at the construction stage.

10.4.12 Where there is no change between the main baseline risk and the main construction risk, the temporary effect significance is deemed to be negligible even if the risk is deemed to be high. For example, this will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the area required for construction.

10.4.13 A worsening risk at construction stage compared to baseline will result in a negative effect, and conversely, an improvement will result in a positive effect. The assessment assumes that contamination will be controlled through the general measures in the CoCP.

10.4.14 All of the sites set out in Table 22have been assessed for the change in impact associated with the construction stage of the work. Table 23 presents the summary of the resulting construction effects that have been found to be significant. All other sites referenced in Table 22 were found to have non-significant effects. The details of the full assessment are presented in Volume 5: Appendix LQ-001-002.

Table 23: Summary of temporary (construction) effects

Name and area ref[147]	Receptor	Main baseline risk	Main construction risk	Temporary effect
Infilled ponds at Hoo Mill 2-41	Human health (direct contact, ingestion, inhalation of vapours from contaminated soils, waters and inhalation of ground gases on site)	Moderate/low	N/A (exposure pathways removed)	Moderate beneficial (significant)

[147] Each potentially contaminated site is allocated a unique reference number (See Volume 5: Appendix LQ-001-002).

Name and area ref[147]	Receptor	Main baseline risk	Main construction risk	Temporary effect
Tank within farmyard at Upper Hanyards Farm 2-56	Human health (direct contact, ingestion, inhalation of vapours from contaminated soils, waters and inhalation of ground gases on site)	Moderate/low to moderate	N/A (exposure pathways removed)	Moderate beneficial (Significant)
	Human health (direct contact, ingestion and inhalation of vapours from contaminated water offsite)	Moderate	N/A (exposure pathways removed)	Moderate beneficial (significant)
	Controlled waters – groundwater	High	Moderate/low	Moderate beneficial (significant)
	Property (direct contact with contaminated soil and water)	Moderate/low	Very low	Moderate beneficial (significant)
Staffordshire County Showground landfill (Elmstar Plant) 2-69	Human health (direct contact, ingestion, inhalation of vapours from contaminated soils, waters and inhalation of ground gases on site)	Moderate/low	N/A (exposure pathways removed)	Moderate beneficial (significant)
Kents Barn Farm No. 3 landfill 2-106	Controlled waters – groundwater	Moderate/low	High	Moderate adverse (significant)
Dismantled railway, Hopton 2-189	Human health (direct contact, ingestion, inhalation of dusts and vapours from contaminated soils on site)	Moderate	Low	Moderate beneficial (significant)
	Controlled waters - Groundwater (Secondary A)	Moderate/low	High	Moderate adverse (significant)
Potential anthrax infected cattle burial site, Hopton 2-208	Human health (direct contact, ingestion, inhalation of vapours from contaminated soils, waters and inhalation of ground gases on site)	Moderate/low to moderate	N/A (exposure pathways removed)	Moderate beneficial (significant)

10.4.15 Table 23 indicates that there are two locations where there will be a significant adverse effect, and five locations where there will be a significant beneficial effect. In

relation to the significant adverse effecst relating to the former landfill at Kents Barn Farm No. 3 and the dismantled railway at Hopton, with the application of site-specific remediation, the adverse effects are expected to reduce and are not considered to be significant in relation to potential land contamination.

10.4.16 Significant beneficial effects are anticipated in relation to the infilled ponds at Hoo Mill, the former tank at Upper Hanyards Farm, the landfill at Staffordshire County Showground, the dismantled railway at Hopton and the potential anthrax burial site at Hopton. These effects are largely due to the removal of exposure pathways as a result of construction activities, as the sites lie within the area required for construction of the Proposed Scheme.

10.4.17 The Hopton South cutting will pass close to the Staffordshire County Showground landfill (Elmstar Plant) and may require excavation into what is expected to be backfilled material. The landfill is unlined and records indicate that the backfill material is inert construction material. The impact has been assessed as a beneficial effect due to the removal of landfilled material during excavation of the cutting.

10.4.18 Construction compounds located in the Colwich to Yarlet area will include the storage of potentially hazardous substances, such as fuels and lubricating oils, and may also be used for temporary storage of potentially contaminated soils. Mitigation measures set out within the draft CoCP include management of risks from the storage of such materials.

Permanent effects

10.4.19 In order to identify potential permanent effects, a screening assessment has been undertaken comparing the baseline and post-construction CSM to assess the permanent (post-construction) effects.

10.4.20 Table 24 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. The details of the assessment are presented in Volume 5: Appendix LQ-001-002.

10.4.21 The magnitude of the permanent effects and their significance have been determined by assessing the change in risk between the main baseline risk and the main post-construction risk. Therefore, where there is no change between the main baseline risk and the main post-construction risk, the permanent effect significance is deemed to be negligible even if the risk is assessed to remain as high. This will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the area required for construction of the Proposed Scheme. As noted above, a worsening will result in negative effects and an improvement will result in positive effects.

Table 24: Summary of permanent (post-construction) effects

Name and area ref[148]	Receptor	Main baseline risk range	Main post-construction risk range	Post-construction effect
Farms on Principal aquifer 2-71, 2-55, 2-83, 2-85, 2-76, 2-213	Controlled waters – groundwater (Principal aquifer)	High	Moderate/low	Moderate beneficial (significant)
Tank within farmyard at Upper Hanyards Farm 2-56	Human health (direct contact, ingestion, inhalation of vapours from contaminated soils, waters and inhalation of ground gases on site)	Moderate/low to moderate	N/A (exposure pathways removed)	Moderate beneficial (Significant)
	Human health (direct contact, ingestion and inhalation of vapours from contaminated water offsite)	Moderate	N/A (exposure pathway removed)	Moderate beneficial (significant)
	Controlled waters – groundwater (Principal aquifer)	High	Very low	Major beneficial (significant)
	Controlled waters – surface water	Moderate/low	Very low	Moderate beneficial (significant)
	Property (direct contact with contaminated soil and water)	Moderate/low	Very low	Moderate beneficial (significant)
Staffordshire County Showground landfill (Elmstar Plant) 2-69	Controlled waters – groundwater (Principal aquifer)	High	Moderate/low	Moderate beneficial (significant)
Dismantled railway, Hopton 2-189	Controlled waters - Groundwater (Secondary A aquifer)	Moderate/low	Very low	Moderate beneficial (significant)
	Controlled waters – surface water	Moderate/low	Very low	Moderate beneficial (significant)

10.4.22 Where remediation is carried out for sites within land required for the construction of the Proposed Scheme, there will be a significant beneficial effect at four locations: Upper Hanyards Farm, the historical tank at Upper Hanyards Farm, the dismantled railway at Hopton and Staffordshire County Showground landfill (Elmstar Plant).

10.4.23 The beneficial effect associated with the farms on principal aquifer occurs as a result of changes at Upper Hanyards Farm. The other farms on principal aquifer were not assessed to have a permanent beneficial effect.

[148] Each potentially contaminated site is allocated a unique reference number (See Volume 5: Appendix LQ-001-002 and Land Quality Map Book).

10.4.24 For Upper Hanyards Farm, there have been historical risks to groundwater due to the presence of a tank on the farm. The water supply to this farm and Lower Hanyards Farm comes from a borehole on the farm which extracts water from the aquifer at risk. The proposed scheme will result in the demolition of Upper Hanyards Farm and its borehole. For the future, water supply to Lower Hanyards Farm will likely need to come from a mains supply resulting in a beneficial effect on drinking water quality.

10.4.25 Moderate beneficial post-construction effects are expected at the landfill at the Staffordshire County Showground, as landfilled waste will be removed to create the Hopton South cutting in that location. If the majority of the landfilled waste, which may also be producing gas, was to be removed, the beneficial effects would include an improvement in groundwater quality and a reduction in risk to human health and property receptors.

10.4.26 The significant beneficial effect at the dismantled railway in Hopton will arise because the former railway line is within the area required for construction of the Proposed Scheme. Remediation could reduce the risks to surface water quality and improve groundwater quality.

10.4.27 Additional site-specific permanent remediation measures that could focus on source removal, pathway breakage or receptor protection will be developed during the detailed design stage if required. These measures will ensure that risks to people and property from gas and vapours in the ground will be controlled to an acceptable level.

Mining/mineral resources

10.4.28 Construction of the Proposed Scheme has the potential to affect existing mineral resources, proposed areas of mineral exploitation and/or petroleum/gas reserves. This could occur by sterilisation of the resource through direct excavation during construction of the Proposed Scheme or through temporary and/or permanent severance[149] or isolation that may occur during the construction of the Proposed Scheme, possibly continuing through to its operation.

Temporary effects

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

10.4.30 The following compounds fall within the MSAs:

- Trent South embankment main compound;
- Trent South embankment temporary worker accommodation;
- Trent North embankment satellite compound;

[149] 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.

- Hopton South cutting satellite compound;
- Sandon Road auto-transformer station satellite compound; and
- Hopton North cutting satellite compound.

Permanent effects

10.4.31 The route of the Proposed Scheme will cross two MSAs: one for sand and gravel extraction and one for bedrock sand extraction. These permanent works will sterilise the sand and gravel deposits below the construction footprint, with a strip of mineral becoming sterilised. However, as a proportion of the total MSA, this strip is less than 1% of the total, and the effect on the MSA is considered to be minor and therefore not significant. Mitigation measures (if any) will be discussed in advance of the works with the Mineral Planning Authority, SCC, and the mineral owner.

10.4.32 The route of the Proposed Scheme will cross an area in which brine extraction might be possible, near Stafford, however, it is understood that brine is not considered to be a mineral resource by SCC.

10.4.33 The route of the Proposed Scheme will cross an area underlain by coal seams of the South Staffordshire Coalfield. Construction of the Proposed Scheme may constrain the working of coalfield resources in a strip of land below and surrounding the route, however, it is understood there are no current plans to work the coalfield. Construction of the Proposed Scheme is unlikely to place a constraint on future exploitation of potential sources of coal bed methane.

10.4.34 Table 25 reports the assessment of permanent effects from construction on the mining and mineral resources identified.

Table 25: Summary of effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance (Y/N)
MSA – bedrock sand	MSA	MSA for bedrock sand extraction, defined by SCC[150]	Medium	Minor	Negligible (N)
MSA – sand and gravel	MSA	MSA for sand and gravel extraction, defined by SCC	Medium	Minor	Negligible (N)
Stafford Halite Formation	Unknown	Brine resource in the Stafford area	Low	Minor	Negligible (N)
South Staffordshire Coalfield	Extent of hydrocarbons	Extent of hydrocarbon resource. Deep coal defined as between 50m and 1,200m by SCC	Likely to be low	Negligible	Negligible (N)

10.4.35 All the potential effects identified are negligible and it is assessed that there are no significant effects with respect to mineral resources.

[150] Staffordshire County Council, (2015) *The Minerals Local Plan for Staffordshire 2015-2030, adopted 16 February 2017.*

Geo-conservation sites

10.4.36 No geo-conservation areas, such as SSSI or LGS, have been identified in the study area.

Other mitigation measures

10.4.37 At this stage, no additional measures are considered necessary to mitigate risks from land contamination during the construction stage beyond those that are set out in the draft CoCP and/or instigated as part of the site specific remediation strategies that will be developed during the detailed design stage if required. These measures will ensure that risks to people, the environment and property from contaminants in the ground will be controlled such that they will not be significant. For example, measures might include excavation and treatment of contaminated soils or controls to manage movement of landfill gas and leachate.

10.4.38 Mitigation of the effects on mineral resources within the proposed MSA could include extraction of the resource, for use within the Proposed Scheme, or elsewhere. Extraction from below the structural footprint of the route of the Proposed Scheme will not occur, as the permanent railway will require good founding conditions. A plan will be discussed in advance of the construction works with the landowner, the mineral planning department at SCC, and any other relevant parties to assist in achieving an effective management of minerals within the affected location of the MSA.

Summary of likely residual significant effects

10.4.39 Based on the information currently available, and with the application of the mitigation measures detailed above, there will be a significant beneficial effect anticipated, associated with remediation of the landfill at Staffordshire County Showground and the dismantled railway line at Hopton. Significant beneficial effects are also anticipated as a result of construction of the Proposed Scheme resulting in a change from on-site water supply to a future mains water supply. Otherwise, no likely significant residual effects are anticipated with respect to land quality.

Cumulative effects

10.4.40 No significant cumulative temporary or permanent effects during construction with regard to land contamination, mineral resources or geo-conservation sites are anticipated.

10.5 Effects arising from operation

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

Avoidance and mitigation measures

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

Assessment of impacts and effects

10.5.3 The Proposed Scheme within this area will include three auto-transformer stations, located at Moreton, Mill Lane, Sandon Road, and Yarlet express feeder auto-transformer station. 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 will be included in the installed design.

10.5.4 The operation of the trains may give rise to minor contamination through leakage of hydraulic or lubricating oils. However, any such leakage or spillage is expected to be very small and unlikely to result in significant contamination.

Other mitigation measures

10.5.5 No other mitigation measures are expected to be required beyond what has already been outlined relating to land quality in the study area.

Summary of likely residual significant effects

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

Cumulative effects

10.5.7 No cumulative effects during operation on land quality receptors have been identified in the Colwich to Yarlet area.

Monitoring

10.5.8 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

10.5.9 Requirements for monitoring will be determined as part of the site investigation, treatment and validation of contamination on a site specific basis as part of the detailed design process. Monitoring requirements may include water quality, air quality and/or (landfill) gases, depending on the site being considered.

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 Colwich to Yarlet area. It summarises the baseline conditions found within and around the route of the Proposed Scheme and describes the likely impacts and significant effects during construction and operation on landscape and visual receptors.

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

11.1.3 Engagement has been undertaken with Staffordshire County Council (SCC), the Cannock Chase Area of Outstanding Natural Beauty (AONB) Unit, Natural England, the Canal & River Trust and the National Trust. The purpose of this engagement has been to discuss the assessment methodology, the extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages.

11.1.4 Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in the Volume 5: Landscape and Visual Map Book and Volume 5: Appendix LV-001-002 which comprises the following:

- Part 1 Engagement with technical stakeholders;
- Part 2 Landscape character assessment;
- Part 3 Visual assessment; and
- Part 4 Assessment matrices.

11.1.5 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

11.1.6 The Volume 2: CA2 Map Book also includes Map Series LV-03 (Construction phase viewpoints), Map Series LV-04 (Operation phase viewpoints) and Map Series LV-01 (Verifiable photomontages), showing viewpoints that will be significantly affected.

11.1.7 A separate, but related, assessment of effects on historic landscape character and the setting of heritage assets is reported in Section 7, Cultural heritage.

11.2 Scope, assumptions and limitations

11.2.1 The scope, key assumptions and limitations for the landscape and visual assessment are set out in full in Volume 1 (Section 8), the Scope and Methodology Report (SMR)[151] and the SMR Addendum[152] .

11.2.2 Winter surveys for the landscape and visual assessment were undertaken from January to March 2016 and in February 2017 to inform the assessment. Summer field surveys, including photographic studies of landscape character areas (LCA) and assessment of visual receptor viewpoints, were undertaken from July to September 2016. During the baseline survey, there were some areas that were inaccessible (such as private land, commercial premises and residential buildings). In these instances, professional judgement has been used to approximate the likely views from these locations.

11.2.3 The extent of the study area has been informed by construction and operational phase zones of theoretical visibility (ZTV). The ZTV have been produced in line with the methodology described in the SMR and SMR Addendum, and are an indication of the theoretical visibility of the Proposed Scheme. In some locations, extensive vegetation cover will mean the actual visibility is substantially less than that shown in the ZTV, and professional judgement on site visits has been used to further refine the study area to focus on likely significant effects.

11.2.4 Tall construction plant (for example cranes and piling rigs) is excluded from the ZTV for the construction phase, as there is a great degree of variability in the extent and timeframes of the visibility of construction activity and plant. Overhead line equipment rarely gives rise to significant effects if it is the only element visible and has, therefore been excluded from the ZTV to give a better indication of the possible spread of significant effects to aid the assessment. Overhead line equipment is described and taken into account in the assessment of effects on LCAs and visual receptors.

11.2.5 Landscape and visual receptors within approximately 500m of the Proposed Scheme have been assessed as part of the study area. Long distance views of up to 1km have been considered at the settlement edges of Stafford and Hixon, and of over 1km at Shugborough Park and at Broc Hill within the Cannock Chase AONB.

11.2.6 Professional judgements on landscape value, susceptibility and sensitivity are discussed in the baseline descriptions in the proformas in Volume 5: Appendix LV-001-002, Part 2.

11.3 Environmental baseline

Existing baseline

Landscape baseline

11.3.1 The study area extends from Colwich in the south to Yarlet in the north. It is a lowland, rural river valley landscape lying between the River Trent and the River Sow, and

[151] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[152] Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methdology Report Addendum.

includes an intricate patchwork of tree-lined watercourses and lowland pasture fields and meadows (including a site cited as the best example of inland salt marsh in the UK at the Pasturefields Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI), and the remains of salt marsh and a saltspring pool at Lionlodge Covert). A small area of heathland, north of Within Lane, is also the site of the English Civil War battle of Hopton Heath.

11.3.2 The study area has a strong visual relationship with the prominent wooded escarpment and foothills associated with Cannock Chase and the Cannock Chase AONB, which falls within a small part of the study area at Shugborough and Tixall (approximately 600m from the route of the Proposed Scheme at its closest point). Key landscape features in the area contributing to the 'special qualities' of the AONB include the registered park and garden of Shugborough Park, and the medieval and later designed landscapes and parklands at Tixall and Ingestre.

11.3.3 A number of historic settlements are scattered across the study area, notably the villages of Hopton, Yarlet and Whitgreave, along with larger nucleated villages, such as Little Haywood and Great Haywood. These are located predominantly within a local landscape with field boundary patterns that have remained relatively intact for centuries. Larger development is limited to the Ministry of Defence (MoD) Stafford, Staffordshire University and business parks lying between Stafford and Hopton, and MoD depots north of Hopton. Large linear transport corridors are a locally prominent feature of the area, notably the M6, A34 Stone Road and A51 Lichfield Road, as well as the WCML, the latter two generally follow the River Trent Valley within the study area.

11.3.4 The LCAs have been determined as part of an integrated process of environmental characterisation, informed by the outcome from other topics, including the historic landscape character and ecological assessments. Use has been made of published landscape character assessments, historic landscape characterisation (HLC) and a wide range of supporting GIS data, aerial photography and Ordnance Survey mapping, plus desk study and fieldwork, and the findings of related topic assessments, such as cultural heritage. Landscape character assessments reviewed include the relevant National Landscape Character Areas and the Staffordshire Landscape Guidelines. More detail on the approach to the landscape characterisation is set out in the SMR Addendum.

11.3.5 For the purposes of this assessment, the study area for Colwich to Yarlet has been subdivided into nine LCAs. Full descriptions are contained within Volume 5: Appendix LV-001-002, Part 2.

Visual baseline

11.3.6 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 Volume 2: CA2 Map Book, Map Series LV-03 and Map Series LV-04). They are described and assessed in full in the proformas in Volume 5: Appendix LV-001-002, Part 3. In each case, the middle number (xxx-**xx**-xxx) identifies the type of receptor that is present in this area – 1: Protected views (none within this area), 2: Residential,

3: Recreational[153], 4: Transport, 5: Hotels/healthcare (none within this area) and 6: Employment (none within this area).

11.3.7 No protected views have been identified within the study area. Residential visual receptors within the study area are located within large settlements, including Great Haywood, Little Haywood and Stafford, as well as within villages, such as Hopton, and smaller villages and hamlets, such as Moreton, Tixall, Ingestre, Marston and Yarlet, and numerous farmsteads. Views from settlement edges are typically filtered and framed by intervening and field boundary vegetation, which owing to low lying and gently undulating landform, restrict open views to some degree.

11.3.8 A range of recreational visual receptors are located in Shugborough Park, within the Cannock Chase AONB, along the Trent and Mersey Canal and the Staffordshire and Worcestershire Canal and their associated foot and cycle paths; Great Haywood Marina; Staffordshire County Showground; and Ingestre Park Golf Club.

11.3.9 Views from recreational receptors on elevated positions, including the viewpoint at Triumphal Arch at Shugborough Park and from Broc Hill within the AONB are long range and panoramic over wooded and gently undulating landform. However, typically, views from the majority of public rights of way (PRoW) in the Colwich to Yarlet area are lower lying and restricted by extensive woodland and parkland tree cover on the surrounding slopes. Views from the Trent and Mersey Canal, the Staffordshire and Worcestershire Canal and Ingestre Park are typically channelled by boundary vegetation.

11.3.10 Views for users travelling on scenic roads, such as Tixall Road, are typically characterised by parkland and mature field boundary vegetation and field trees and gently undulating landform, providing a degree of visual filtering and framing to views.

11.3.11 Views from transport visual receptors travelling on the A51 Lichfield Road are characterised to the south by roadside barriers and mature vegetation, which restricts views out. To the north, where the A51 Lichfield Road follows the River Trent Valley, the roadside vegetation is generally field hedgerows, which seasonally allow longer views, as does the A34 Stone Road to the west.

11.3.12 Views from healthcare receptors include Mayfield Children's Home (Moreton House), where open views are available across parkland and farmland. As Mayfield Children's Home is also a residential facility the receptors are identified as residential, and therefore, of high sensitivity.

11.3.13 Users of the PRoW adjacent to St. Leonard's Church in Marston are also identified as visual receptors.

[153] 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.

Future baseline

Construction (2020)

11.3.14 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2020.

11.3.15 The committed developments/allocations that materially affect the baseline conditions for landscape and visual receptors in this area and form part of the future baseline assessment of the effects during construction and operation are listed in Table 26.

Table 26: Committed developments relevant to landscape and visual

Map Book Reference[154]	Planning Reference	Description
CA2/11	Policy SA1 - Canalside site	Allocation for recreation and leisure facilities.
CA2/41	Policy Stafford 2 - North of Stafford – Housing	Allocation for two housing sites for around 3,100 dwellings in total.

Operation (2027)

11.3.16 Volume 5: Appendix CT-004-000 provides details of the developments in the Colwich to Yarlet area that are assumed to have been implemented by 2027.

11.3.17 There are no further committed developments which will affect the baseline conditions during operation of the Proposed Scheme.

11.4 Temporary effects arising during construction

11.4.1 As is commonplace with major infrastructure works, the scale of the construction activities means that works will be visible in many locations and will have the potential to give rise to significant temporary effects that cannot practicably be mitigated. Such effects are temporary and will vary over the construction period depending on the intensity and scale of the works at the time. The assessment of landscape and visual effects has been based on the activities occurring during the peak construction phase, which is defined as the period during which the main construction works will take place, including the establishment of compounds, main earthworks and structure works.

11.4.2 The effects associated with the peak construction stage in this area are generally considered to be medium-term, based on the indicative construction programme in Section 2.3. The peak civil engineering stage in this area will be undertaken between the start of 2021 and the end of 2024. Effects during other stages of works are likely to be less intensive due to less construction equipment being required at the time and a reduced intensity of construction activity.

[154] Volume 5 Map Book: Maps CT-13-105b to CT-13-109a-R1

11.4.3 Section 2.2 sets out the the key permanent features of the Proposed Scheme and Section 2.3 describes the construction compounds and associated temporary works that have been considered in this assessment.

Avoidance and mitigation measures

11.4.4 Measures that have been incorporated into Sections 12 and 14 of the draft Code of Construction Practice (CoCP)[155] to avoid or reduce landscape and visual effects, where reasonably practicable, during construction include the following:

- 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[156];
- 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;
- design of lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses; and
- replacement of any trees intended to be retained which may die as a consequence of nearby construction works.

11.4.5 Implementation of these measures has been taken into account in the assessment of the construction effects.

Assessment of temporary impacts and effects

11.4.6 The most apparent changes to the landscape and to the views experienced by visual receptors during construction will relate to the presence of construction plant, compounds and soils and material storage and stockpiling. Key construction activities that will give rise to the most apparent changes to landscape and visual receptors are: excavation of cuttings; erection of viaducts; construction of embankments; the removal of existing landscape elements, including trees and hedgerows; and the closure and diversion of existing roads, lanes and PRoW. Other key changes include the construction of overbridges and underbridges, and the presence of transfer nodes and demolitions of buildings and structures.

11.4.7 Significant landscape and visual effects on Shugborough Park during construction are not anticipated due to the distance from the Proposed Scheme, the local topography and the enclosed nature of the park. The dense tree belt that surrounds much of the park is anticipated to partially screen views, including those from higher viewpoints, even in winter months.

Landscape assessment

11.4.8 The following five LCAs will be significantly affected during construction, see Table 27 below. Full details of effects are described in Volume 5: Appendix LV-001-002, Part 2.

[155] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.
[156] BS 5837:2012 Trees in relation to design, demolition and construction – Recommendations, 2012, British Standard.

Table 27: Construction phase significant landscape effects

Great Haywood Settled Plateau Farmland Slopes	**Medium susceptibility and sensitivity**
The scale of the Proposed Scheme through the centre of the rural landscape and large scale construction activity, which will include the presence of tower cranes, will change the character of the predominantly rural landscape. Construction will result in substantial changes to the local topography from large scale earthworks, the introduction of temporary material stockpiles. The character will also be changed by the removal of of locally distinctive and historic landscape features, such as the mature tree line at Moreton House and the widening of Bishton Lane (removing the mature hedgebanks and trees) for construction vehicle access, and the demolition of Tithebarn Farm[157]. The landscape will be further impacted by construction vehicle movements and noise which will change the tranquillity of the rural landscape. Due to the landscape severance and loss of distinctive local historic landmarks, construction of the Proposed Scheme will result in a **high magnitude of change and a major adverse effect**, which is significant.	
Ingestre Park Sandstone Estatelands	**High susceptibility and sensitivity**
The Proposed Scheme will sever the landscape and visual relationship between the historic designed landscapes within the LCA. Direct impacts will result from the introduction of large scale earthworks associated with Trent North embankment and Brancote South and North cuttings. Changes to the landscape pattern will result from the demolition of buildings at Upper Hanyards Farm and Chase View, and removal of mature woodland and sections of the historic tree belt boundary of Tixall Park and the severance of the historic Hanyards Lane. In addition, rare landscape features such as the saltspring pool will be lost. The tranquil, rural landscape, accessed only by Hanyards Lane, will be temporarily disrupted by the presence of construction traffic routes, site haul routes, satellite compounds and the introduction of uncharacteristic features, such as material stockpiles, that will alter a substantial proportion of the character area. Construction of the Proposed Scheme will result in a **high magnitude of change and major adverse effect**, which is significant.	
Ingestre Riparian Alluvial Lowlands	**High susceptibility and sensitivity**
The southern extent of the LCA will be directly affected by the concentration of large scale construction activities in this small scale, intimate and historic landscape. A large area adjacent to the A51 Lichfield Road will be used for temporary construction works including the Trent South embankment main compound, worker accommodation, batching plant, temporary material stockpiles and transfer nodes. The use of Mill Lane as a construction traffic route and the noise, movement and scale of the works over a long duration will change the tranquillity and scale of the historic landscape which will be perceptible from a wider area within the LCA than will be directly affected by the construction works. In addition, perception of the LCA from outside its boundaries will change. Construction of the Proposed Scheme will result in a **high magnitude of change and major adverse effect**, which is significant.	
Hopton Sandstone Estatelands	**High susceptibility and sensitivity**
The Proposed Scheme will pass through the landscape south of Hopton, which sits on an elevated point of high geological interest. Construction will be within an area of rural landscape that is an important visual break between the village and Stafford. Direct impacts will result from the construction of Hopton South and Hopton North cuttings, which will sever the village from the rural landscape. These cuttings and the earthworks of the realigned B5066 Sandon Road will substantially change and be at variance with the local landform. In addition, the demolition of buildings at Hopton and permanent diversions of local lanes and PRoW will change the historic landscape pattern and recreational accessibility of the landscape. Large scale temporary changes to the landscape character will result from the site haul routes and the use of the A518 Weston Road and B5066 Sandon Road as construction traffic routes. Material stockpiles will further sever the landscape and visual connections with the wider landscape. Construction of the Proposed Scheme will result in a **high magnitude of change and major adverse effect**, which is significant.	
Stone and Whitgreave Settled Farmlands	**Medium susceptibility and sensitivity**
The direct changes in this landscape during construction will affect the historic settlement of Marston and the historic landscape around Yarlet. There are direct impacts upon local landmarks, such as the loss of historic field patterns and the partial loss of The Grove (a distinctive woodland on top of Yarlet Hill) through which the Proposed Scheme will pass in a large cutting. In addition, Marston village will be divided as the route of the Proposed Scheme passes through it. Temporary construction effects will include the large scale works and material stockpiles alongside the majority of the length of the Proposed Scheme, which will change the local landform and the visual relationship with the River Trent Valley. Construction will include planting of woodland on the footprint of a historic woodland block to compensate for the removal woodland at The Grove.	

[157] This is also shown on OS mapping as Tithe Barne Farm

The length of the Proposed Scheme within the landscape, large scale earthworks, temporary road realignments, material stockpiles along with site haul routes, satellite compounds and utilities works will result in numerous substantial local changes through the LCA.

Construction of the Proposed Scheme will therefore result in a **high magnitude of change and a major adverse effect**, which is significant.

Visual assessment

Introduction

11.4.9 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken for the winter period, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities may be reduced during summer when vegetation, if present in a view, will be in leaf. Where residential receptors experience significant effects at night-time arising from additional lighting, these are also presented in this section. Visual receptors who will experience non-significant effects are reported in Volume 5: Appendix LV-001-004.

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

11.4.11 The assessment has not identified any locations within this study area where additional lighting continuous night working and/or overnight working during construction will result in significant visual effects at night.

11.4.12 Table 28 describes the construction phase significant visual effects. These are described in detail in Volume 5: Appendix LV-001-001 and shown in Map Series LV-03 in the Volume 2: CA2 Map Book.

Table 28: Construction phase significant visual effects

Views south from residences and PRoW at Moreton Farm (VPs 007-03-005, 007-03-013, 007-03-015 and 008-03-001)
Residents at Moreton Farm and users of the footpaths will experience close-range views of large scale construction works including Moreton Brook viaduct (within the Fradley to Colton area (CA1)) and associated embankments, Moreton cutting, and the Colwich Bridleway 23 accommodation green overbridge. The removal of mature vegetation will result in substantial changes to the extent, content, skyline and character of views and remove distinctive local landscape features. Close-range views of construction works will be visible from several PRoW, with temporary and permanent diversions required, changing the receptor experience of the landscape. Whilst some of the construction works will be partially screened from receptors by the local topography, the works will be visible in proximity across the majority of the views. There will be direct, close-range views from the upper storeys at Moreton House across the construction of Moreton cutting, and the removal of the mature tree line will change the extent and character of these views. In addition, views of large scale construction vehicles, equipment and earthworks will introduce uncharacteristic movement to the views. Construction activity will result in a **high magnitude of visual change and major adverse effect,** which is significant. The view of the Proposed Scheme from viewpoint 007-03-013 and 007-03-015 during construction is illustrated on the photomontage shown in Figures LV-01-583 and LV-01-670 (Volume 5: Appendix LV-001-002).

Views from PRoW at Moreton Barn Farm and Far Coley Farm
(VPs 008-03-002 and 008-03-006)

Users of the footpath near Far Coley Farm will experience medium-range views of large scale construction works including Moreton Brook viaduct (within the Fradley to Colton area (CA1)) and associated embankments, Moreton cutting, and the removal of mature hedgerows and trees along Bishton Lane. Users of the footpath near Moreton Barn Farm will have distant views changed by the removal of Little Covert and the demolition of Tithebarn Farm.

The removal of mature vegetation will result in substantial changes to the extent, content, skyline and character of these views and the loss of distinctive local landscape features. In addition, views of large scale construction vehicles, equipment and earthworks will introduce uncharacteristic movement to the views.

Construction activity will result in **a medium magnitude of visual change and moderate adverse effect,** which is significant.

Views from PRoW at Gorse House, Tolldish Lane and Coley Lane
(VPs 008-03-004, 008-02-005 and 008-02-007)

Residents at the viewpoint locations and users of the footpath at Gorse House will have longer range views of construction activity that will result in large scale changes to the character of the views. The removal of mature Tithebarn Covert woodland and demolition of Tithebarn Farm will change the character and extent of some views, and the introduction of large scale temporary material stockpiles will introduce engineered forms to the rural landscape. Some residents will also have views changed by the large scale construction activity associated with Great Haywood viaduct and the associated embankments.

Construction activity will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views north-east from the A51 Lichfield Road
(VP 008-04-016)

Large scale construction works will be undertaken in proximity to the viewpoint location and the use of the A51 Lichfield Road as a construction traffic route will substantially change the view. The movement of equipment, vehicles and large scale earthworks adjacent to the A51 Lichfield Road will be readily perceptible by road users, with direct views of the removal of roadside vegetation and construction of the A51 Lichfield road underbridge.

Construction activity will result in a **high magnitude of visual change and moderate adverse effect,** which is significant.

Views north from Great Haywood
(VPs 008-02-017 and 008-03-020)

Large scale construction works will be undertaken in proximity to the northern and eastern edges of Great Haywood. Residents will generally have views partially filtered by existing mature vegetation in the foreground. The use of the A51 Lichfield Road as a construction traffic route and the proximity of large scale construction works will substantially change the character of available views. The movement of equipment, vehicles and earthworks will be readily perceptible, with construction of Great Haywood viaduct visible across the skyline.

Users of Colwich Bridleway 58 will have open, close-range views towards construction of the Trent South embankment and the associated woodland removal will change the character and content of the rural views. Construction activity will dominate and earthworks will reduce the length of views.

In addition, there will be views towards activity at the Trent South embankment main compound, transfer nodes, material stockpiles and temporary worker accommodation adjacent to the A51 Lichfield Road, until the point which Trent South embankment blocks the view.

Construction acitivity will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views from the Trent and Mersey Canal
(VPs 009-03-002 and 009-03-003)

Users of the canal and the canal towpath (Colwich Footpath 63) will have mid-range views towards construction of Great Haywood viaduct and Trent South and Trent North embankments. Views will be filtered to varying degrees by canalside vegetation and largely screened during summer months, however there will be large scale changes to the skyline.

The introduction of the Great Haywood viaduct will dominate views from some distance and change the small scale, historic character and the skyline of views across the open valley floor.

Due to the distance of the large scale construction works from these viewpoints there will be a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from the Trent and Mersey Canal and Mill Lane
(VPs 009-03-007, 009-03-008, 009-03-021 and 009-02-024)

Users of the canal and users of the canal towpath (Colwich Footpath 63) will have sequential views towards construction of Great Haywood viaduct and Trent South and Trent North embankments. Views from close to Great Haywood Marina will be dominated by construction of Great Haywood viaduct. Views towards the open valley floor will be filtered to varying degrees by

canalside vegetation and largely screened during summer months. However, there will be large scale changes to the length of views and to the skylines.

The scale of the construction works and the Great Haywood viaduct will dominate close-range views and entirely change the historic character, length and skyline of mid-range views to the open valley floor. The use of Mill Lane as a construction traffic route will have additional effects, introducing construction vehicle movements to the view.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 009-03-008 during construction is illustrated on the photomontage shown in Figure LV-01-587 (Volume 5: Appendix LV-001-002).

Views north from Great Haywood Road
(VP 009-02-015)

Residents of Tixall Manor Farm will have close to medium-range views dominated by the construction of Great Haywood viaduct and associated embankments, introducing construction equipment, vehicle movements and structures into the open valley floor landscape. The woodland removal at Lionlodge Covert will be a large scale activity in proximity to residential receptors, however, the retained woodland will provide the same backdrop to views until temporary material stockpiles are in place. The stockpiles, construction vehicle movements and large scale earthworks will be in proximity to the residential receptors, dominating and foreshortening the views.

Construction acitivity will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views north from the Staffordshire and Worcestershire Canal and Tixall Gatehouse
(VPs 009-03-010 and 009-03-019)

Long distance views from Tixall Gatehouse will be partially screened and filtered by vegetation depending on the time of year, however construction activity will be discernible and will introduce incongruous elements to the rural landscape. Visitors and guests to this property will have their attention focused on the rural landscape setting and the panoramic views from the roof terrace, which are a feature of the Gatehouse. Walkers using The Way for the Millennium long distance footpath along the Staffordshire and Worcestershire Canal will have long-range views to large scale construction works for Trent North embankment.

Due to the distance of construction works from the receptors, changes to the skyline from the removal of mature woodland and the nature of the works being incongruous with existing views across the historic designed parkland and the historic character of the canal, there will be a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views south from Ingestre Park Road
(VPs 009-02-016 and 009-02-022)

Residents will have direct, close-range views from upper and lower storeys at Lion Lodges to the construction of Trent North embankment. Construction will introduce large scale vehicle movements, equipment and earthworks including the use of Great Haywood Road for a construction traffic route.

Residents at Little Ingestre will have longer-range views to the removal of mature woodland for construction of Trent South embankment that will change the character of the view and open up views to the construction works. Construction of Great Haywood viaduct will be discernible also. Construction within Ingestre Park Golf Club and south of Lionlodge Covert will be screened by retained trees and woodland. A large scale material stockpile to the east of the golf club house will however be visible.

Construction acitivity will result in a **high magnitude of visual change and major adverse effect**, which is significant.

View from Tixall Park
(VP 010-03-005)

Users of the bridleway through Tixall Park will have close-range views towards the construction works, dominated by the large scale earthworks for Brancote South cutting and Tixall Bridleway 0.1628 accommodation overbridge. There will be also views of a satellite compound and temporary material stockpiles. These will introduce structures, construction activity and large scale earthworks into the views of the rural, parkland landscape. The demolition of Upper Hanyards Farm and the removal of surrounding woodland will be an additional change to the historic character of the view and of the skyline.

Construction activity will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views from Hanyards Lane
(VP 010-04-007)

The view for road users along Hanyards Lane (010-04-007) will change within the mid-ground, particularly with the demolition of Upper Hanyards Farm. The use of Hanyards Lane as a construction traffic route will dominate the view at all ranges.

Road users on Hanyards Lane will experience a **high magnitude of visual change and a moderate adverse effect**, which is significant.

Views from Tixall Park
(VPs 010-03-009 and 011-03-002)

Users of the bridleways will have medium-range views towards the construction of Brancote North and South cuttings.

In views to the west from around the Staffordshire County Showground (010-03-009 and 011-03-002), the majority of Brancote South cutting will be just below or at ground level with less change to existing topography and partial screening by intervening topography. Changes to the views will result from temporary material stockpiles which will shorten and change the character of views. In addition, construction equipment and vehicle movements will introduce a further discordant element to the rural views.

Users of the bridleways will experience a **medium magnitude of visual change and a moderate adverse effect**, which is significant.

Views from residences and PRoW at Hopton
(VPs 011-03-001, 011-03-003, 011-03-004, 011-02-005, 011-02-007, 011-03-011, 011-03-015, 012-02-001 and 012-02-003)

Residents at Hopton and users of the footpaths around the village will have close-range views of the construction of the Proposed Scheme. Views from Hopton and the PRoW at Beacon Hill (on the route of the Two Saints Way long distance path) are elevated and will include long views across construction of a long section of the Proposed Scheme. There is relatively little existing vegetation south of Hopton, so the removal of any of this vegetation will be more readily perceived. There is also little opportunity for mature vegetation being retained for screening. The views will be dominated by construction of the large scale Hopton North cutting and Hopton South cutting, the introduction of mitigation earthworks, the earthworks of the realigned B5066 Sandon Road overbridge and a balancing pond. All these elements will require substantial construction equipment and vehicle movements, and will introduce engineered land forms at variance with the local topography. Views from the north to Beacon Hill will be blocked by temporary material stockpiles and by the permanent mitigation earthworks and views to the north from Beacon Hill will experience the introduction of construction works resulting in the visual severance of Hopton and Mount Edge.

In addition, changes including the alignment of local lanes, a new track to a balancing pond and the Hopton and Coton new footpath overbridge will introduce hard surfaces and structures to the currently open, rural views.

The construction works will change the character of the views and the open rural setting of Hopton which is an important break between the village and the urban edge of Stafford; the construction works will occupy a large proportion of this space.

Users of a footpath between the A518 Weston Road and Hopton Pools will have views changed by the realignment of the A518 Weston Road and introduction of the associated earthworks and overbridge structure, and temporary material stockpiles. Some users of footpaths and residents at Mount Edge will have close-range views (011-03-001, 011-03-003, 011-03-005 and 012-02-001) but undulating topography will provide some localised screening (011-03-004).

Due to the scale and proximity of construction works to residents and users of the PRoW and the elevated views across the works from Hopton, there will be a **high magnitude of visual change and major adverse effects**, which is significant.

The view of the Proposed Scheme from viewpoint 011-02-007 and 011-03-011 during construction is illustrated on the photomontage shown in Figure LV-01-588 and LV-01-589 (Volume 5: Appendix LV-001-002).

Views from B5066 Sandon Road
(VP 012-04-005)

Road users of the B5066 will have close-range views of construction works, predominantly the realignment of the B5066 Sandon Road, the diversion of Hopton Lane and the associated removal of existing mature roadside hedgerow and trees. The retained mature roadside hedgerow will provide substantial screening of other close-range construction works, however construction equipment and vehicle movements will be perceptible.

The realignment of the B5066 Sandon Road will give rise to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from the Stone Circles Challenge long distance path and Hopton and Coton Bridleway 11 (VPs 012-03-008 and 012-03-011)

Walkers using the adjacent Stone Circles Challenge footpath will have close-range views of the construction of Hopton North cutting and the realignment of the B5066 Sandon Road. Construction of these elements involve large scale earthworks in addition to temporary material stockpiles within 200m of the viewpoint. Hopton North cutting satellite compound will also be visible, albeit beyond a temporary material stockpile. In summer the views will be largely screened by hedgerows alongside the footpath, but winter views will be dominated by the introduction of engineered landforms into the gently sloping landscape, the loss of existing mature hedgerows and trees and loss of views to the woodland to the east and south-east. Residents at Kents Barn Farm will also experience these close range changes to the view and will also have upper storey views which will not be screened by the existing hedgerow. Land allocated (The Plan for Stafford, 2011-2031) north of the A513 Beaconside Road for housing development will not be visible from the viewpoint location.

Viewpoint 012-03-008 will be dominated by the scale and proximity of construction works. Users of the bridleway at viewpoint 012-03-011 will have mid-ground views of the Proposed Scheme. The viewpoint lies within an area allocated for housing development. Large scale construction works for Hopton North cutting will dominate the skyline.

Construction of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Views north from residences at Marston and Yarlet, and from PRoW Marston Footpaths 1 and 2 (VPs 013-03-002, 013-02-004, 013-02-006 and 013-03-014)

The Proposed Scheme will pass very close to residences on Yarlet Lane and PRoW in Marston. Residences on the north side of Yarlet Lane will have direct views to the construction of Marston North embankment and a section of the Proposed Scheme on low embankment, and some views also to the end of Marston South embankment and Yarlet South cutting.

The proximity of the Proposed Scheme will dominate views and the removal of existing vegetation and hedgerows will be a substantial change to the rural character. Long-distance views across the River Trent Valley will be interrupted by a site haul route, and temporary material stockpiles and mitigation earthworks will permanently block views. Marston North embankment satellite compound will dominate views from properties at the western end of Yarlet Lane.

The locally distinctive landmark of The Grove (a distinctive woodland on top of Yarlet Hill) will be partially removed and Yarlet Hill will be excavated for Yarlet South cutting, resulting in large scale changes to the local topography and character of views. The removal of roadside vegetation will further open up views to the A34 Stone Road.

Users of Marston Footpath 1 (013-03-002) will have close range, partially screened, views of construction works including building demolition and embankment earthworks associated with Marston South embankment and landscape mitigation earthworks. Views from Marston Footpath 2 (013-03-014) will be more distant but will be dominated by construction works across the full width of the view including the embankment earthworks but also the large temporary material stockpiles that will line the Proposed Scheme south of the viewpoint location, blocking the existing view and skyline.

Due to the dominance and proximity of construction works in these locations there will be a **high magnitude of visual change and major adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 013-03-002 and 013-02-006 during construction is illustrated on the photomontage shown in Figure LV-01-592 and LV-01-591 (Volume 5: Appendix LV-001-002).

Views from the A34 Stone Road
(VPs 013-04-016 and 013-04-018)

Users of the A34 Stone Road will have views of the removal of mature roadside vegetation, the demolition of Middlebank Farm and construction of the A34 Stone Road temporary realignment (013-04-016). There will be open views to the west to construction of the A34 Stone Road temporary realignment and associated removal of existing mature roadside hedgerows, and trees in the mid-ground from 013-04-018. In addition, there will be close-range views to a temporary material stockpile and the Yarlet South cutting satellite compound.

Vegetation removal and the introduction of the road corridor to the rural landscape will give rise to a **high magnitude of visual change and moderate adverse effect**, which is significant.

Views north from Green Lane at Pirehill Grange Farm
(VP 014-03-009)

The Proposed Scheme will pass across the mid-ground of the view in Yarlet Central cutting and on Yarlet embankment, on lower ground. Longer views will be interrupted by construction works introducing large scale equipment and temporary material stockpiles to the rural view. Recreational receptors will have mid-range views of construction activities with relatively little intervening vegetation.

Construction activities will result in a **high magnitude of change and major adverse effect,** which is significant.

The view of the Proposed Scheme from viewpoint 014-03-009 during construction is illustrated on the photomontage shown in Figure LV-01-593 (Volume 5: Appendix LV-001-002).

Other mitigation measures

11.4.13 To reduce the significant effects described above, consideration will be given during the detailed design stage to where planting can be established early in the construction programme, including early planting in ecological mitigation sites, which will have the additional benefit of providing some visual screening. However, not all landscape and visual effects can be mitigated due to the visibility of construction activity and the sensitivity of surrounding receptors. No other mitigation measures are considered practicable during construction.

Summary of likely residual significant effects

11.4.14 The temporary residual significant effects during construction remain as described above. These effects will be temporary and reversible in nature lasting only for the duration of the construction works. These residual effects will generally arise from the widespread presence of construction activity and construction plant within the landscape and viewed from surrounding residential receptors, and users of PRoW and main roads within the study area.

11.4.15 The significant effects that will remain after implementation of construction phase mitigation are summarised below:

- major adverse significant effects in relation to five LCAs;
- major adverse significant visual effects at 12 residential viewpoint locations;
- major adverse significant visual effects at 20 recreational viewpoint locations;
- moderate adverse effects at eight recreational viewpoint locations; and
- moderate adverse effects at five transport viewpoint locations.

Cumulative effects

11.4.16 No significant cumulative temporary or permanent effects during construction are anticipated.

11.5 Permanent effects arising from operation

11.5.1 The permanent features of the Proposed Scheme that have been taken into account in determining the effects arising during operation on landscape and visual receptors are presented in Section 2.2 of this report. Permanent changes within the landscape and views caused by the construction are assessed in this section.

Avoidance and mitigation measures

11.5.2 The operational assessment of impacts and effects is based on year 1 (2027), year 15 (2042) and year 60 (2087) of the Proposed Scheme. A process of iterative design and assessment has been employed to avoid or reduce adverse effects during the

operation of the Proposed Scheme. Measures that will be incorporated into the design of the Proposed Scheme include:

- design of earthworks to tie the engineering earthworks for embankments (such as for the viaducts) and cuttings into their wider landscape context and to mitigate views of structures and overhead line equipment from sensitive receptors where reasonably practicable. Earthworks also consider the relationship to surrounding land uses and management, such as agriculture;
- the introduction of the Ingestre green overbridge on a precautionary basis to provide ecological connectivity (which will also provide historic landscape connectivity for Ingestre's historic park and garden);
- modification of the Colwich Bridleway 23 accommodation green overbridge at Moreton to support hedgerow planting to provide ecological benefit and to mitigate visual effects;
- compensatory woodland planting in areas of loss using the same species composition and planting types, including restored parkland shelterbelts at Ingestre and Lionlodge Covert 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 the Proposed Scheme mitigation into the wider landscape character; and
- compensation for loss of field ponds with new wetlands, ecological ponds and biodiversity wetland features.

Assessment of impacts and effects

11.5.3 The likely effects on landscape and visual receptors during operation of the Proposed Scheme relate to the presence of new structures and elements in the landscape including the Great Haywood viaduct over the River Trent and Trent and Mersey Canal, the presence of earthworks and new landforms at Hopton, plus the severance of landscape connectivity at Moreton, Ingestre, Tixall, Marston and Yarlet. Other aspects include the presence of overhead line equipment, noise fence barriers, and the presence of auto-transformer stations at Moreton, Mill Lane and B5066 Sandon Road, and an express feeder auto-transformer station at Yarlet.

11.5.4 Significant landscape and visual effects on Shugborough Park are not anticipated due to the distance from the Proposed Scheme, the local topography and the enclosed nature of the park. The dense tree belt that surrounds much of the park is anticipated to partially screen views, including those from higher viewpoints, even in winter months.

11.5.5 Significant effects on the setting of the Cannock Chase AONB are not anticipated by virtue of distance from the Proposed Scheme, the degree of topographical variation and the screening provided by forestry plantation and other woodland to the AONB's scarp slope. The effects of the Proposed Scheme on the AONB are discussed in

Volume 3, Route-wide effects, and in the relevant LCA proformas within Volume 5: Appendix LV-001-002, Part 2.

Landscape assessment

11.5.6 The following five LCAs will be significantly affected during operation, see Table 29. Full details of effects are described in Volume 5: Appendix LV-001-002, Part 2.

Table 29: Operational phase significant landscape effects

Great Haywood Settled Plateau Farmland Slopes	**Medium susceptibility and sensitivity**

Year 1:

In year 1, the landscape will be directly affected by the severance of the landscape and loss of distinctive historic landscape pattern, features and vegetation such as Bishton Lane and the mature tree line at Moreton. New access tracks, the widened Bishton Lane and Moreton auto-transformer station will increase the extent of hard surfaces and fencing in addition to the route of the Proposed Scheme itself, associated noise fence barriers, and overhead line equipment. Colwich Bridleway 23 accommodation green overbridge will support hedgerow planting for ecological benefits, but this will also reinstate some landscape connectivity for Moreton. Mitigation tree planting to the south of Moreton North embankment will be relatively established by operation but other mitigation planting will have no beneficial effects in year 1. The introduction of large scale infrastructure and earthworks north of Great Haywood, bridge structures, and the change to the historic landscape pattern resulting from the realignment of Tolldish Lane and loss of mature woodland, will permanently change the LCA.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of change and major adverse effects**, which is significant.

Year 15:

Whilst mitigation planting along the Proposed Scheme will provide some integration of structures into the landscape by summer of year 15, the changes to the landscape pattern and land form will remain.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of change and major adverse effects**, which is significant.

Year 60:

The maturity of mitigation planting at year 60 will have reinstated the vegetation pattern at Bishton Lane, but the historic character of the lane will have changed and the hedgebanks will not be reinstated. The large scale permanent changes to the land form, severance of the landscape and PRoW network, and permanent changes to distinctive local features such as Bishton Lane and the setting to Moreton House will remain.

Operation of the Proposed Scheme at year 60 will remain a **high magnitude of change and a major adverse effect**, which is significant.

Ingestre Park Sandstone Estatelands	**High susceptibility and sensitivity**

Year 1:

In year 1, the permanent severance of the historic landscapes at Ingestre and Tixall and loss of the historic line of Hanyards Lane and woodland will directly affect the landscape. Mitigation woodland planting between Lambert's Coppice and Ingestre Wood will be provided for reinstatement of the wider historic woodland planting pattern. Mitigation planting across the Ingestre green overbridge will not be sufficiently established at year 1 to reduce effects and the introduction of structures and infrastructure will result in incongruous elements.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of change and major adverse effects**, which is significant.

Year 15:

By year 15 the established mitigation planting on the embankment of Trent North embankment will provide connectivity and integration of Trent North embankment and Brancote South cutting. The mitigation planting, including the reinstatement of woodland at a break in a historic shelter belt, will have localised minor beneficial effects. To the west, due to mitigation planting being limited to hedgerows, the Proposed Scheme will continue to dominate the landscape. By year 15 the mitigation planting on Ingestre green overbridge will have established and will provide some landscape connectivity, however this planting is limited to hedgerow and shrub planting.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of change and major adverse effect**, which is significant.

Year 60:

By year 60 the maturity of mitigation woodland planting along the Proposed Scheme and the reinstatement of the wider historic woodland planting pattern will provide some landscape integration and restoration. However, to the west the

mitigation planting comprises only hedgerows and the Proposed Scheme will remain visible. The Proposed Scheme infrastructure and train movements will remain visible, incongruous elements to the west.

Operation of the Proposed Scheme at year 60 will reduce to a **medium magnitude of change and moderate adverse effect**, which is significant.

Ingestre Riparian Alluvial Lowlands	**High susceptibility and sensitivity**

Year 1:

In both summer and winter of year 1 of operation there will be limited direct effects on the landscape. However, the introduction of Trent South embankment will result in a substantial change to the open valley landscape and the Great Haywood viaduct will change the perception of the valley landscape from long distances. The intimate scale and character of the Trent and Mersey Canal Conservation Area will be degraded by the scale of the viaduct.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of change and major adverse effects**, which is significant.

Year 15:

Whilst earthworks will be partially integrated by established mitigation planting along the Proposed Scheme by summer of year 15, the change to the landscape pattern and land cover will remain. Infrastructure elements will be partially screened and their effects reduced, but Great Haywood viaduct will remain visible from much of the landscape.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of change and major adverse effect**, which is significant.

Year 60:

By year 60 the mature mitigation planting along the Proposed Scheme will provide partial screening of the viaduct from some locations, but the large scale change to natural land form and land cover and high magnitude of change will persist.

Operation of the Proposed Scheme at year 60 will remain a **high magnitude of change and major adverse effect**, which is significant.

Hopton Sandstone Estatelands	**High susceptibility and sensitivity**

Year 1:

In both summer and winter of year 1 of operation, the effects on landscape form, character and settlement setting resulting from the Proposed Scheme will dominate the landscape. Introduction of uncharacteristic earthworks including the Hopton South and North cuttings, mitigation landscape earthworks and the B5066 Sandon Road realignment will add to the changes to the local network of lanes and PRoW. In addition, elements such as the retaining wall and noise fence barriers will change the rural character.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of change and major adverse effects**, which is significant.

Year 15:

By summer of year 15, the establishment of mitigation planting along the Proposed Scheme and on the landscape earthworks will provide some integration of earthworks and Hopton North cutting, but will change the land cover from open grassland to woodland. Despite the established planting providing some integration of the structures and earthworks, this will result in uncharacteristic changes to the landscape pattern.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of change and major adverse effects**, which is significant.

Year 60:

By year 60, whilst the mature mitigation planting will provide screening of the Proposed Scheme and integration of structures south of Hopton, the introduction of woodland planting will remain a change to the landscape pattern. East of Hopton, the mitigation hedgerow planting, whilst reflecting the local landscape pattern, will not provide any visual integration of elements of the Proposed Scheme such as overhead line equipment.

Operation of the Proposed Scheme at year 60 will remain a **high magnitude of change and major adverse effects**, which is significant.

Stone and Whitgreave Settled Farmland	**Medium susceptibility and sensitivity**

Year 1:

In year 1 of operation, the Proposed Scheme will result in permanent landscape severance and loss of distinctive topography, historic field and settlement patterns, and local landmark features including Yarlet Hill and The Grove (a distinctive woodland on top of Yarlet Hill). Mitigation planting in this landscape will be predominantly hedgerow planting and grassland creation and the Proposed Scheme will be at or near grade at Marston North embankment, with Yarlet express auto-transformer feeder station, overhead line equipment, noise fence barriers and train movements introducing substantial changes to the character

and tranquillity of the landscape. Mitigation woodland planting on the footprint of a historic block of woodland will not be sufficiently established to provide any beneficial effects at year 1.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of change and major adverse effect**, which is significant.

Year 15:

By the summer of year 15, the establishment of mitigation planting on landscape earthworks and around the A34 Stone Road will provide integration of the mitigation earthworks and reinstate a historic woodland footprint, however changes to the character of the historic settlements and the landscape pattern, along with the presence of the Proposed Scheme, will remain.

Operation of the Proposed Scheme at year 15 will reduce to a **medium magnitude of change and moderate adverse effect**, which is significant.

Year 60:

At year 60 the maturity of mitigation planting will provide localised benefits but the permanent changes to the historic landscape pattern and settlements will persist.

Operation of the Proposed Scheme at year 60 will remain a **medium magnitude of change and moderate adverse effect**, which is significant.

Visual assessment

Introduction

11.5.7 The following section describes the likely significant effects on visual receptors during operation year 1, year 15 and year 60 (with effects on all identified visual receptors, including those representing more distant viewpoints and visual receptors within the AONB, discussed in full in Volume 5: Appendix LV-001-002, Part 1). The assessment has been undertaken for the winter period, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of the operational Proposed Scheme may be reduced during summer when vegetation, if present in a view, will be in leaf and winter and summer scenarios are therefore considered for year 1 and summer scenarios for year 15 and year 60, to capture worst case and best case.

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

11.5.9 The assessment has not identified any locations within this study area where additional lighting in operation of the Proposed Scheme will result in significant visual effects at night.

11.5.10 The assessment has identified locations where the operation of the Proposed Scheme will result in significant effects (summarised in Table 30 and described in detail in Volume 5: Appendix LV-001-002, Part 3).

Table 30: Operational phase significant visual effects

Views south from PRoW at Moreton Farm (VP 007-03-005)
Year 1 winter and summer: At year 1 users of the bridleway will experience large scale changes to close range views during operation of the Proposed Scheme. Bridleway users will experience elevated views of the Moreton Brook viaduct (within the Fradley to Colton area (CA1)) and associated embankments, noise fence barriers and overhead line equipment. There will be changes to the skyline resulting from the removal of the distinctive mature tree line. Much of the cutting earthworks, the overhead line equipment and the passing trains in Moreton cutting will be screened due to the depth of the cutting. Mitigation planting will not provide any screening or landscape integration at this stage, but there will

be localised benefits resulting from the undergrounding of the power lines at Moreton Brook and the mitigation tree planting south of Moreton Brook viaduct.

The Proposed Scheme will result in a substantial alteration of key characteristics of the view, such as the local landform and vegetation, and will introduce new, urbanising features in the view.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15:

By year 15, established mitigation planting on Moreton North embankment will visually integrate and filter views to Moreton Brook viaduct and noise fence barriers. Mitigation hedgerow and woodland planting at Moreton auto-transformer station will provide further screening, however the changes to the view within the mid-ground and introduction of movement of trains will remain a substantial change.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of visual change and major adverse effect**, which is significant.

Year 60:

At year 60 the maturity of mitigation planting will reduce remaining views east towards Moreton Brook viaduct and Moreton auto-transformer station.

However, the permanent change in the character of views resulting from the proximity of the Proposed Scheme to users of the bridleway and the loss of distinctive local landscape features such as the mature tree line on the horizon will persist.

Operation of the Proposed Scheme at year 60 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views south from PRoW at Moreton and Upper Moreton Farm (VPs 007-03-013 and 007-03-015)

Year 1 winter and summer:

At year 1 users of the bridleway (007-03-013) and recreational users of Upper Moreton Farm (007-03-015) will experience large scale changes to close range views during operation of the Proposed Scheme. Recreational users of Upper Moreton Farm will experience elevated views of the Moreton Brook viaduct (within the Fradley to Colton area (CA1)) and associated embankments, noise fence barriers and overhead line equipment.

Some of the cutting earthworks, the overhead line equipment and the passing trains within Moreton cutting will be screened from users of the bridleway by the depth of Moreton cutting. Mitigation planting will not provide any screening or landscape integration at this stage, but there will be localised benefits from the undergrounding of the power lines at Moreton Brook and the mitigation tree planting south of Moreton Brook viaduct. The Proposed Scheme will result in a substantial alteration of key characteristics of the view, such as the local landform and vegetation, and will introduce new, urbanising features in the view.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

The view of the Proposed Scheme from viewpoint 007-03-013 and 007-03-015 during operation year 1 is illustrated on the photomontage shown in Figures LV-01-518 and LV-01-680 (Volume 5: Appendix LV-001-002).

Year 15:

By summer year 15, views of Moreton cutting will be partially screened and filtered by established mitigation planting south of Moreton House. However, due to its proximity, the route of the Proposed Scheme will remain very apparent, especially within residential views out from Moreton House. Mitigation planting south of the Moreton auto-transformer station will change the length of views from 007-03-013 and the land cover and character the views. Established mitigation planting south of Moreton north embankment will provide visual integration and screening of the embankment and of Moreton Brook viaduct but will also change the character of the landscape within the view. Established mitigation hedgerows will screen the access track to the balancing pond.

Operation of the Proposed Scheme at year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

At year 60 the maturity of mitigation planting will reduce remaining views east towards Moreton Brook viaduct. The Moreton auto-transformer station and Colwich Bridleway 23 accommodation green overbridge will be enclosed by mitigation woodland and hedgerow planting and other mitigation planting will partially screen the Proposed Scheme.

Due to the permanent change in the character of views, the proximity of the Proposed Scheme to receptors, operation of the Proposed Scheme at year 60 will reduce to non-significant, as reported in Volume 5: Appendix LV-001-002.

Views south from residences and PRoW at Moreton Farm (VP 008-03-001)

Year 1:

At year 1 users of the bridleway will experience large scale changes to close range views during operation of the Proposed Scheme. Bridleway users will experience views across Moreton cutting and associated embankments and overhead line equipment. There will be substantial change to the view resulting from the removal of the distinctive mature tree line in front of Moreton House.

Much of the cutting earthworks, the overhead line equipment and the passing trains in Moreton cutting will be screened due to the depth of the cutting. Mitigation planting will not provide any screening or landscape integration at this stage, and will change the character of the foreground of the view.

The Proposed Scheme will result in a substantial alteration of key characteristics of the view, such as the local landform and vegetation, and will introduce new, urbanising features in the view.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15:

By year 15, established mitigation hedgerow planting west of the viewpoint will screen the view along Moreton cutting. Established mitigation woodland planting within the foreground will heavily filter and reduce views, resulting in substantial change.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of visual change and major adverse effect**, which is significant.

Year 60:

Due to the scale of the changes in the view and permanent loss of distinctive landscape features, operation of the Proposed Scheme at year 60 will remain a **high magnitude of visual change and major adverse effect**, which is significant.

Views from PRoW at Far Coley Farm and Moreton Barn Farm (VPs 008-03-002 and 008-03-006)

Year 1 winter and summer:

Due to the distance of the Proposed Scheme from the bridleway at Moreton Barn Farm and the footpath at Far Coley Farm, and due to the removal of existing mature vegetation in views from Colwich Footpath 36, operation of the Proposed Scheme at year 1 winter and year 1 summer at viewpoint 008-03-006, will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Due to leaf cover on intervening existing vegetation providing screening, for recreational receptors at Moreton Barn Farm (008-03-002) operation of the Proposed Scheme at year 1 summer will reduce to non-significant, as reported in Volume 5: Appendix LV-001-001.

Year 15 and 60:

Operation of the Proposed Scheme in year 15 will reduce to non-significant and remain so in year 60, as reported in Volume 5: Appendix LV-001-002.

Views from Tolldish and Coley Lane

(VPs 008-03-004, 008-02-005 and 008-03-007)

Year 1 winter and summer:

In winter year 1 of operation, views off Trent South embankment and train movements will change the rural views. The loss of existing mature woodland within the views from Tolldish (008-03-004) and Coley Lane (008-02-007) will also change the skyline and mid-ground respectively.

Operation of the Proposed Scheme at year 1 winter and summer will result in a **medium adverse magnitude of visual change and moderate adverse effect**, which is significant.

Year 15:

At year 15 the establishment of mitigation woodland planting alongside the Proposed Scheme will partially filter the Proposed Scheme, however changes resulting from the loss of existing mature vegetation and visibility of frequent train movements will remain.

Operation of the Proposed Scheme at year 15 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

Due to the maturity of mitigation planting reducing the visibility of the Proposed Scheme, operation of the Proposed Scheme at year 60 will reduce to non-significant, as reported in Volume 5: Appendix LV-001-002.

Views north-east from the A51 Lichfield Road
(VP 008-04-016)

Year 1 winter and summer:

Transport receptors will have close-range views of large scale elements of the Proposed Scheme including Trent South embankment and the A51 Lichfield Road underbridge, along with the removal of existing mature vegetation in the view.

Operation of the Proposed Scheme at year 1 winter and summer will result in a **high magnitude of visual change, resulting in moderate adverse effects** in winter and summer, which is significant.

Year 15 and year 60:

Due to the establishment of mitigation woodland planting on Trent South embankment and around the balancing pond, and screening provided by existing mature roadside vegetation, operation of the Proposed Scheme at year 15 will reduce to non-significant and remain so in year 60, as reported in Volume 5: Appendix LV-001-002.

Views north from Great Haywood
(VPs 008-02-017 and 008-03-020)

Year 1 winter and summer:

At year 1 summer and winter, residential receptors (008-02-017) will be primarily affected by views of the Great Haywood viaduct, and associated noise fence barriers, overhead line equipment, and the Trent North embankment. Intervening existing vegetation will partially screen the Trent South embankment and the A51 Lichfield Road underbridge from users of Colwich Bridleway 58 (008-03-020) and mitigation planting will not provide any screening or landscape integration at this stage. Changes to the wooded skyline and open views will be emphasised by frequent train movements.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15:

At year 15, established mitigation woodland planting on Trent South embankment will partially integrate the embankment with the existing intervening vegetation in residential views (008-02-017). However, the Great Haywood viaduct will continue to be a substantial change. Established mitigation planting on Trent South embankment will provide some visual integration and filtering of the view to the embankment and associated infrastructure for users of Colwich Bridleway 58 (008-03-020), however the Proposed Scheme will continue to dominate the view.

Operation of the Proposed Scheme at year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect,** which is significant.

Year 60:

At year 60, visual effects will remain due to the change in the views resulting from Great Haywood viaduct and the proximity of Trent South embankment from viewpoint 008-02-017 and the change to the length and character of the view from viewpoint 008-03-020.

Operation of the Proposed Scheme at year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Views from the Trent and Mersey Canal
(VPs 009-03-002 and 009-03-003)

Year 1 winter and summer:

At winter year 1, views across the River Trent Valley floor will be dominated by the large scale Great Haywood viaduct which will change long-distance views towards Cannock Chase AONB. Frequently passing trains will be partially screened by noise fence barriers and Trent North embankment will be perceptible.

Operation of the Proposed Scheme at year 1 will result in a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 15 and year 60:

Due to the screening provided by existing vegetation, visual effects will reduce to non-significant in year 15 and remain so in year 60, as reported in Volume 5: Appendix LV-001-002.

View from the Trent and Mersey Canal
(VP 009-03-008)

Year 1 winter and summer:

At year 1 winter, recreational receptors close to Great Haywood Marina will have the view dominated by the Great Haywood viaduct. Whilst existing canal side vegetation will provide some screening in summer, the scale of the viaduct will dominate and be a substantial change to the historic character and scale of the view. Mitigation planting on Trent South embankment will not provide any screening or landscape integration at this stage.

At year 1 winter and summer, operation of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effects**, which is significant.

The view of the Proposed Scheme from viewpoint 009-03-008 during operation year 1 is illustrated on the photomontage shown in Figure LV-01-636, LV-01-524 and LV-01-658 (Volume 5: Appendix LV-001-002).

Year 15:

By year 15 summer, the establishment of mitigation planting on Trent South embankment will provide partial landscape integration of the embankment and screening of overhead line equipment and noise fence barriers. Views of the Great Haywood viaduct crossing the canal cannot be further mitigated.

Operation of the Proposed Scheme at year 15 will reduce to a **medium magnitude of visual change and moderate adverse effects**, which is significant.

Year 60:

At year 60 the maturity of mitigation planting will not provide any additional screening of the viaduct however Trent South embankment will be well integrated with existing vegetation in the mid-ground.

Operation of the Proposed Scheme at year 60 will remain a **medium magnitude of visual change and moderate adverse effects**, which is significant.

Views from the Trent and Mersey Canal and Mill Lane (VPs 009-03-007, 009-03-021 and 009-02-024)

Year 1 winter and summer:

At year 1 winter, users of the canal towpath close to Great Haywood Marina (009-03-007) will have views dominated by the Great Haywood viaduct. Users of the canal towpath (009-03-021) and residential receptors (009-02-024) from further away will also have views dominated by the introduction of Great Haywood viaduct across the open valley floor, partially screened in summer by intervening towpath vegetation and existing roadside hedgerows respectively.

Whilst existing vegetation will provide some screening in summer, the scale of the viaduct and its introduction into views across the open valley landscape view will be a substantial change, even where it is a small or distant part of those views. Mitigation planting will not provide any screening or landscape integration at this stage.

At year 1 winter and summer, operation of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effects**, which is significant.

The view of the Proposed Scheme from viewpoints 009-03-007 and 009-03-021 during operation year 1 is illustrated on the photomontage shown in Figure LV-01-636, LV-01-524 and LV-01-658 (Volume 5: Appendix LV-001-002).

Year 15:

By year 15 summer, the establishment of mitigation planting on Trent South and Trent North embankments will provide partial landscape integration of the embankments and screening of overhead line equipment and noise fence barriers. However, views towards the Great Haywood viaduct cannot be fully mitigated and screening is dependent on existing canalside and roadside vegetation.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of visual change and major adverse effects**, which is significant.

The view of the Proposed Scheme from viewpoints 009-03-007 and 009-03-021 during operation year 15 is illustrated on the photomontages shown in Figures LV-01-636 and LV-01-658 respectively (Volume 5: Appendix LV-001-002).

Year 60:

At year 60 the maturity of mitigation planting will not provide any additional screening of the viaduct however Trent North embankment will be integrated with existing vegetation in the mid-ground of views from viewpoint 009-03-021. The change to the view resulting from Great Haywood viaduct will remain.

Operation of the Proposed Scheme at year 60 will remain a **high magnitude of visual change and major adverse effects**, which is significant.

Views north from Great Haywood Road
(VP 009-02-015)

Year 1 winter and summer:

At year 1, the introduction of the Great Haywood viaduct, Trent North embankment, noise fence barriers and overhead line equipment will dominate the medium-range views. Leaf cover on existing roadside hedgerows will provide partial screening.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of visual change and major adverse effects**, which is significant.

Year 15:

At year 15 summer, the established mitigation woodland planting around the balancing pond will change the character of the view to the north-east but the visibility of Trent North embankment and Great Haywood viaduct will not reduce.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of visual change and major adverse effects**, which is significant.

Year 60:

The maturity of mitigation planting on Trent North embankment will reinstate the wooded character of the view to the north, however the change to the view resulting from Great Haywood viaduct will persist.

Operation of the Proposed Scheme at year 60 will reduce to a **medium magnitude of visual change and moderate adverse effects**, which is significant.

Views north from the Staffordshire and Worcestershire Canal and Tixall Gatehouse
(VPs 009-03-010 and and 009-03-019)

Year 1 winter and summer:

In winter, recreational receptors at Tixall Gatehouse (009-02-019) will have long-range views to the Great Haywood viaduct and Trent North and Trent South embankments and will perceive the loss of existing mature vegetation. Walkers on The Way for the Millennium long distance path/canal towpath will experience changes to the skyline and the frequent train movements.

Operation of the Proposed Scheme at year 1 winter will result in a **medium magnitude of visual change and moderate adverse effects,** which is significant.

In year 1 summer the views will be predominantly screened by intervening existing vegetation, and operation of the Proposed Scheme will reduce to non-significant, as reported in Volume 5: Appendix LV-001-001

Year 15 and year 60:

Operation of the Proposed Scheme in years 15 and 60 summer will remain non-significant, as reported in Volume 5: Appendix LV-001-002.

Views south from Ingestre Park Road, Little Ingestre
(VP 009-02-016)

Year 1 winter and summer:

At year 1 winter, residents at Little Ingestre will experience partial views of Trent North embankment and train movements at distance.

Operation of the Proposed Scheme at year 1 winter will result in a **medium magnitude of visual change and moderate adverse effects**, which is significant.

At year 1 summer, intervening existing vegetation will provide partial screening of the Proposed Scheme, and operation of the Proposed Scheme will reduce **to** non-significant, as reported in Volume 5: Appendix LV-001-001.

Year 15 and year 60:

Operation of the Proposed Scheme in years 15 and 60 will remain non-significant, as reported in Volume 5: Appendix LV-001-002.

Views south from Ingestre Park Road, Lion Lodges
(VP 009-02-022)

Year 1 winter and summer:

At year 1 winter and summer, residential receptors at Lion Lodges will experience foreshortening of the view to the south due to the introduction of Trent North embankment at close-range.

Operation of the Proposed Scheme at year 1 winter will result in a **high magnitude of visual change and major adverse effects**, which is significant.

Year 15:

At year 15, the establishment of mitigation planting will provide partial screening of the balancing pond to the east and of infrastructure elements on Trent North embankment, however residential views will remain foreshortened by the Trent North embankment.

Operation of the Proposed Scheme at year 15 summer will reduce to **medium magnitude of visual change and moderate adverse effects**, which is significant.

Year 60:

The change to the view will persist at year 60, with the maturity of mitigation planting providing additional screening of the infrastructure elements. The existing woodland backdrop of the view will be reflected by the mitigation woodland planting on the Trent North embankment, however the foreshortening of the view will remain.

Operation of the Proposed Scheme at year 60 summer will remain a **medium magnitude of visual change and moderate adverse effects**, which is significant.

View from Tixall Park
(VP 010-03-005)

Year 1 winter and summer:

Whilst much of the Proposed Scheme will be screened by intervening topography, changes to the view will result from the introduction of infrastructure elements including Tixall bridleway 0.1628 accommodation overbridge and mitigation planting. There is limited intervening vegetation to provide additional screening of the Proposed Scheme.

Operation of the Proposed Scheme at year 1 winter and summer will result in a **high magnitude of visual change and major adverse effects**, which is significant.

Year 15:

The establishment of mitigation woodland planting west of the Tixall bridleway 0.1628 accommodation overbridge will filter views of the Proposed Scheme and reinstate the wooded horizon.

Operation of the Proposed Scheme at year 15 will reduce to a **medium magnitude of visual change and moderate adverse effects**, which is significant.

Year 60:

The maturity of mitigation planting will increase the screening and will reduce the operation of the Proposed Scheme in year 60 to non-significant, as reported in Volume 5: Appendix LV-001-002.

View from Tixall Park
(VP 010-03-009)

Year 1 winter and summer:

Despite the distance from the Proposed Scheme and partial screening from intervening topography there will be views to frequently passing trains between Brancote North cutting and Hopton embankment, introducing incongruous elements to the view.

Operation of the Proposed Scheme at year 1 winter and summer will result in a **medium magnitude of visual change and moderate adverse effects**, which is significant.

Year 15 and 60:

By year 15 the establishment of mitigation hedgerow and woodland planting will partially screen the Proposed Scheme and the operation of the Proposed Scheme will reduce to non-significant and remain so at year 60, as reported in Volume 5: Appendix LV-001-002.

Views south from PRoW and residences at Hopton
(VPs 011-03-003, 011-02-007, 011-03-011 and 012-02-003)

Year 1 winter and summer:

In both summer and winter of year 1, residential and recreational receptors in and around Hopton will have views changed by the introduction of Hopton South and Hopton North cuttings, mitigation earthworks and infrastructure features including noise fence barriers and overhead line equipment. The Proposed Scheme will result in a substantial alteration to the rural views.

Mitigation planting will not provide any screening at this stage and will be a perceptible change in the pattern of land cover. Elevated views across the cutting will be experienced from viewpoints at Cromwell Close (011-02-007) and Beacon Hill (011-03-011).

At year 1 winter, operation of the Proposed Scheme will result in a **high magnitude of visual change and major adverse effects**, which is significant, at all the viewpoints.

The view of the Proposed Scheme from viewpoint 011-02-007 during operation year 1 winter is illustrated on the photomontage shown in Figure LV-01-527 (Volume 5: Appendix LV-001-002).

Year 15:

Mitigation planting will be established, providing some filtering of residential views and visual integration of mitigation earthworks. However, the introduction of the planting into the open landscape will change the character of the views.

Operation of the Proposed Scheme in year 15 will reduce to a **medium magnitude of visual change and moderate adverse effects**, which is significant.

The view of the Proposed Scheme from viewpoint 011-02-007 during operation year 15 summer is illustrated on the photomontage shown in Figure LV-01-640 (Volume 5: Appendix LV-001-002).

Year 60:

The maturity of the mitigation planting will provide increased screening of the Proposed Scheme at year 60, however it will also increase the change to the character of the views from a predominantly open landscape to one with belts and areas of woodland.

Operation of the Proposed Scheme in year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

View along A518 Weston Road
(VP 011-03-001)

Year 1 winter and summer:

Transport receptors will have views dominated by the introduction of Hopton South cutting, the Hopton and Coton Footpath 24 accommodation overbridge and infrastructure elements such as overhead line equipment and train movements. The Proposed Scheme will result in a substantial alteration to the rural views and the B5066 Sandon Road overbridge earthworks will shorten views to the west.

Operation of the Proposed Scheme at year 1 winter will result in a **high magnitude of visual change and major adverse effects**, which is significant. However, in summer, screening provided by the existing mature roadside hedgerow will reduce this to non-significant.

Year 15 and year 60:

Operation of the Proposed Scheme in years 15 and 60 will remain non-significant, as reported in Volume 5: Appendix LV-001-002.

View from PRoW at Hopton
(VP 011-03-004)

Year 1 winter and summer:

Users of Hopton and Coton Footpath 23 will experience views of overhead line equipment and noise fence barriers at Hopton South cutting and filtered views of Hopton and Coton Footpath 24 accommodation overbridge. Changes to the local topography will also be perceived.

Operation of the Proposed Scheme at year 1 winter and summer will result in a **high magnitude of visual change and major adverse effects**, which is significant.

Year 15:

Mitigation hedgerow planting alongside Hopton South cutting will provide partial screening of infrastructure elements and tree movements.

Operation of the Proposed Scheme at year 15 will reduce to a **medium magnitude of visual change and moderate adverse effects**, which is significant.

Year 60:

The maturity of mitigation hedgerow planting and associated trees will provide additional screening of the Proposed Scheme. Operation of the Proposed Scheme at year 60 reduce to non-significant, as reported in Volume 5: Appendix LV-001-002.

Views south from residences and PRoW at Hopton (VP 011-02-005)

Year 1 winter and summer:

Users of Hopton and Coton Footpath 7 will have views dominated by landscape earthworks and will lose the view to Beacon Hill. Hopton North cutting, noise fence barriers, overhead line equipment and train movements will be visible.

Operation of the Proposed Scheme at year 1 winter and summer will result in a **high magnitude of visual change and major adverse effects**, which is significant.

Year 15:

Mitigation woodland planting on the landscape earthworks will partially visually integrate the earthworks, however it will also further reduce the extent of the view. Mitigation woodland planting alongside Hopton North cutting will provide partial screening of infrastructure elements and train movements. The view will remain substantially changed in extent and character.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of visual change and major adverse effects**, which is significant.

Year 60:

The maturity of mitigation woodland planting will provide screening of the Proposed Scheme, however the change to the extent and character of the view will be increased.

Operation of the Proposed Scheme at year 60 will remain a **high magnitude of visual change and major adverse effects**, which is significant.

View from PRoW at Hopton

(VP 011-03-015)

Year 1 winter and summer:

In winter of year 1, recreational receptors at the seating area in Hopton will experience elevated, partially screened and filtered views of the Proposed Scheme and infrastructure features including noise fence barriers and overhead line equipment. The Proposed Scheme will result in a substantial alteration to the mid-ground, rural view.

At year 1 winter, operation of the Proposed Scheme will give rise to a **high magnitude of visual change and major adverse effects**, which is significant, at all the viewpoints.

Due to the screening provided by the existing mature, intervening garden vegetation, operation of the Proposed Scheme at year 1 summer will reduce to non-significant, as reported in Volume 5: Appendix LV-001-001. It is noted that views from residential properties on Wilmore Hill Lane will have upper storey views which will not have the same degree of screening.

Year 15 and 60:

Operation of the Proposed Scheme in years 15 and 60 will remain non-significant in summer, as reported in Volume 5: Appendix LV-001-001.

View from residences at Mount Edge (VP 012-02-001)

Year 1 winter and summer:

In both summer and winter of year 1, residential receptors will experience close range views of the B5066 Sandon Road overbridge and associated earthworks, which will shorten views to the west. Mitigation planting will not provide any screening at this stage but will be a perceptible change in the pattern of land cover at close-range.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of visual change and major adverse effects**, which is significant.

Year 15:

Established mitigation woodland planting at close-range to the viewpoint will change the extent and character of the view. It will visually integrate the B5066 Sandon Road overbridge earthworks and partially screen vehicle movements, however it will be a substantial change to the character of the view.

Operation of the Proposed Scheme at year 15 will remain a **high magnitude of visual change and major adverse effects**, which is significant.

Year 60:

Mitigation planting will be established, providing screening of residential views towards the B5066 Sandon Road overbridge and associated earthworks, however the introduction of the planting into the landscape and loss of longer views will change the character and the extent of the views.

Operation of the Proposed Scheme at year 60 will reduce to a **medium magnitude of visual change and moderate adverse effects**, which is significant.

Views from B5066 Sandon Road
(VP 012-04-005)

Year 1 winter and summer:

Transport receptors will experience mid-ground views of the B5066 Sandon Road realignment and the existing mature roadside hedgerow will heavily filter other elements of the Proposed Scheme. Due to the low sensitivity of transport receptors, operation of the Proposed Scheme at year 1 winter will result in a **medium magnitude of visual change and moderate adverse effects**, which is significant.

Operation of the Proposed Scheme at year 1 summer will reduce to non-significant, as reported in Volume 5: Appendix LV-001-002.

Year 15 and 60:

Operation of the Proposed Scheme in year 15 and 60 will remain non-significant, as reported in Volume 5: Appendix LV-001-002.

Views south-west from the Stone Circles Challenge long distance path
(VP 012-02-008)

Year 1 winter and summer:

In both summer and winter of year 1, recreational receptors will experience close-range views of the B5066 Sandon Road overbridge and earthworks together with the presence of Hopton North cutting and overhead line equipment. The Proposed Scheme will result in a substantial alteration of the length of the view across the rural landscape, introducing engineered land forms, train and vehicle movements and infrastructure elements. Existing hedgerows alongside the PRoW will screen the majority of the Proposed Scheme in summer, however the remaining views and views from upper storeys of Kents Barn Farm will substantially change.

Operation of the Proposed Scheme in winter and summer of year 1 will result in a **high magnitude of change and major adverse effects**, which is significant.

Year 15:

Established mitigation planting on the B5066 Sandon Road realignment earthworks will partially screen vehicle movements and reinstate the wooded character of the view. Overhead line equipment will be partially screened by mitigation hedgerow planting, however the change to the length and character of the view will remain.

Operation of the Proposed Scheme year 15 will remain a **high magnitude of change and major adverse effects**, which is significant.

Year 60:

Mature mitigation planting will provide integration of the B5066 Sandon Road realignment earthworks and increased screening of the Proposed Scheme, however the change to the length and character of the view will persist.

Operation of the Proposed Scheme in year 60 will reduce to a **medium magnitude of change and moderate adverse effects**, which is significant.

Views from the Bridleway to the south
(VP 012-03-011)

Year 1 winter and summer:

There will be open views to Hopton North cutting, overhead line equipment and frequently passing trains on the skyline.

Operation of the Proposed Scheme in year 1 winter will result in a **high magnitude of change and major adverse effects**, which is significant.

In year 1 summer, leaf cover on foreground hedgerows will provide increased screening. Operation of the Proposed Scheme in year 1 summer will therefore reduce to a **medium magnitude of change and moderate adverse effects**, which is significant. It is noted that proposed housing will have elevated views and that the significance of effect will remain major for residential views.

Year 15 and 60:

By year 15 summer, established mitigation planting will provide sufficient screening. Therefore the operation of the Proposed Scheme in year 15 will reduce to non-significant and remain so in year 60, as reported in Volume 5: Appendix LV-001-002.

View from PRoW Marston Footpath 1
(VP 013-03-002)

Year 1 winter and summer:

In winter there will be views to the landscape earthworks, overhead line equipment, noise fence barriers and frequently passing trains. The Proposed Scheme will be at proximity and there will be a loss of longer distance views to the south-west.

Operation of the Proposed Scheme in year 1 winter will result in a **medium magnitude of change and moderate adverse effect**, which is significant.

Leaf cover on intervening existing vegetation at operation of the Proposed Scheme in year 1 summer will reduce the effect of the Proposed Scheme to non-significant, as reported in Volume 5: Appendix LV-001-002

Year 15 and 60:

Operation of the Proposed Scheme in year 15 and year 60 will remain non-significant, as reported in Volume 5: Appendix LV-001-0012.

Views north from residences at Marston and Yarlet and south from PRoW Marston Footpath 2
(VPs 013-02-004, 013-02-006 and 013-03-014)

Year 1 winter and summer:

At year 1 in both summer and winter, residential and recreational receptors will experience close range views of the Marston South and Marston North embankments and associated landscape earthworks. Views will be dominated by views of frequently passing trains, noise fence barriers and overhead line equipment, which will introduce infrastructure elements and block the views across the River Trent Valley. In addition, distinctive local features such as The Grove (a distinctive woodland on top of Yarlet Hill) and Yarlet Hill will have gone from the view. There will be open views from the residential properties on the north side of Yarlet Lane, and upper storey views from residential properties on the south side, predominantly screened by roadside vegetation in summer.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of visual change and major adverse effects**, which is significant.

Year 15:

Whilst planted mitigation earthworks will reduce the visibility of the Proposed Scheme and associated infrastructure elements from Yarlet Lane and established mitigation hedgerows alongside the balancing pond access track will provide some screening for recreational receptors, the changes will persist at year 15 due to the proximity of the Proposed Scheme to receptors and change to the character and length of views.

Operation of the Proposed Scheme at year 15 will remain a hig**h magnitude of visual change and major adverse effects**, which is significant.

Year 60:

Despite the maturity of mitigation planting reinstating the wooded character of some views to the west, the change to the character and length of the view will remain.

Operation of the Proposed Scheme at year 60 will remain a **high magnitude of visual change and major adverse effects**, which is significant.

Views north from Green Lane at Pirehill Grange Farm
(VP 014-03-009)

Year 1 winter and summer:

At year 1 the Proposed Scheme will introduce infrastructure features that are uncharacteristic of and that will foreshorten the existing rural view.

Operation of the Proposed Scheme at year 1 will result in a **high magnitude of visual change and major adverse effect**, which is significant.

Year 15:

At year 15 the establishment of mitigation planting will provide filtering of the Proposed Scheme, however the permanent foreshortening of the view will remain.

Operation of the Proposed Scheme at year 15 will reduce to a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Year 60:

The maturity of mitigation planting will provide increased filtering of the Proposed Scheme, however the permanent foreshortening of the view will remain.

Operation of the Proposed Scheme at year 60 will remain a **medium magnitude of visual change and moderate adverse effect**, which is significant.

Other mitigation measures

11.5.11 The permanent effects of the Proposed Scheme on landscape and visual receptors have been reduced where practicable 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. This will provide additional screening and greater integration of the Proposed Scheme into the landscape. However, no other mitigation measures are considered practicable due to the high visibility of elements of the Proposed Scheme and the sensitivity of the surrounding receptors.

Summary of likely residual significant effects

11.5.12 In many cases, significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. However, the following likely residual significant effects will remain following year 15 of operation:

- major adverse significant effects in relation to four LCA;
- a moderate adverse significant effects in relation to one LCA;
- major adverse significant visual effects at seven residential viewpoint locations;
- major adverse significant visual effects at five recreational viewpoint locations;
- moderate adverse significant visual effects at five residential viewpoint locations; and
- moderate adverse significant visual effects at 11 recreational viewpoint locations.

Cumulative effects

11.5.13 No significant cumulative effects during operation are anticipated.

Monitoring

11.5.14 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

11.5.15 There are no area-specific requirements for monitoring landscape and visual mitigation during the operation of the Proposed Scheme in the Colwich to Yarlet area.

12 Socio-economics

12.1 Introduction

12.1.1 This section reports on the environmental baseline, likely economic and employment impacts as well as significant effects during construction and operation of the Proposed Scheme within the Colwich to Yarlet area. The assessment considers existing businesses, community organisations, local employment and local economies, including planned growth and development.

12.1.2 Engagement with Stafford Borough Council (SBC) and Staffordshire County Council (SCC) has been undertaken as part of the development of the Proposed Scheme. The purpose of the engagement was to increase the understanding of socio-economic characteristics identified through a review of publicly available data.

12.1.3 The socio-economic effects on employment at a route-wide level are reported in Volume 3, Route-wide effects (Section 12).

12.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

12.1.5 In addition, business and labour market data is presented in Background Information and Data (BID)[158].

12.2 Scope, assumptions and limitations

12.2.1 The scope, assumptions and limitations for the socio-economics assessment are set out in Volume 1 (Section 8) and the Scope and Methodology Report (SMR)[159].

12.3 Environmental baseline

Existing baseline

Study area description

12.3.1 The following provides a brief overview of employment, economic structure, labour market and business premises availability within the Colwich to Yarlet area.

12.3.2 It lies within the administrative area of Stafford Borough within the County of Staffordshire. It also falls within the Stoke-on-Trent and Staffordshire Local Enterprise Partnership (LEP) area[160] and West Midlands region.

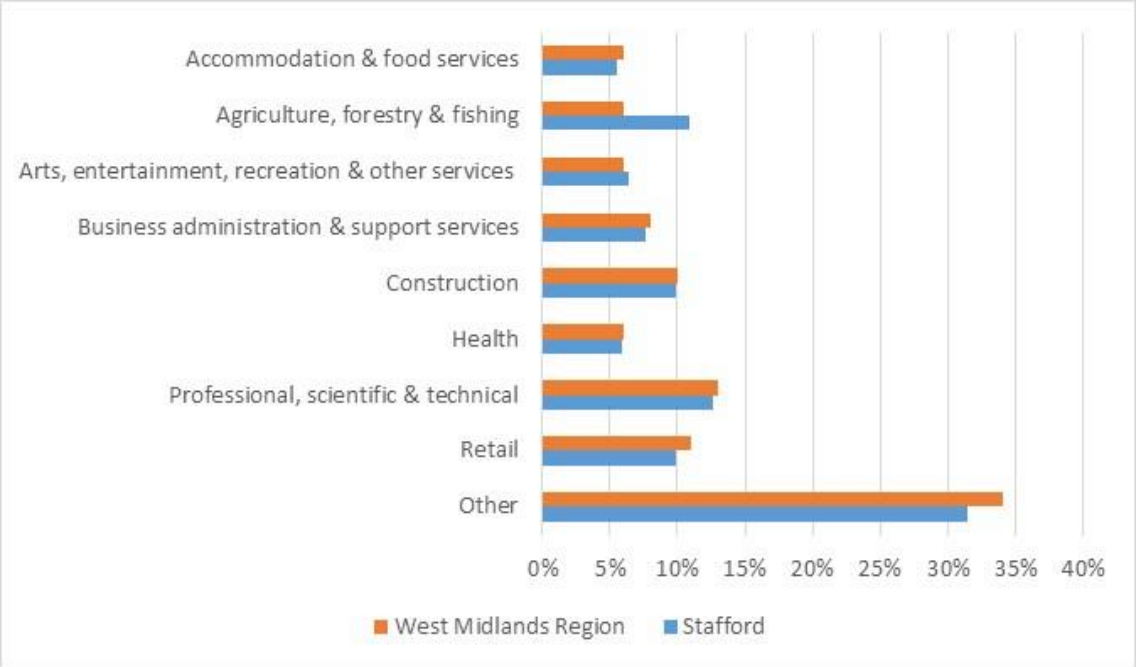
Business and labour market

12.3.3 Within the SBC area there is a wide spread of business types reflecting a diverse range of commercial activities. The professional, scientific and technical sector accounts for the largest proportion of businesses (13%), with agriculture, forestry and fishing the

[158] Background Information Data: BID-SE-001-000, Business and labour market data. Available online at: www.gov.uk/hs2
[159] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[160] Stoke-on-Trent and Staffordshire Local Enterprise Partnership, (2014), *Strategic Economic Plan Summary March 2014*.

second largest (11%) followed by retail and construction (10% each). This is shown in Figure 8. For comparison within the West Midlands region, the largest sectors were professional, scientific and technical (13%), followed by retail (11%) and construction (10%)[161].

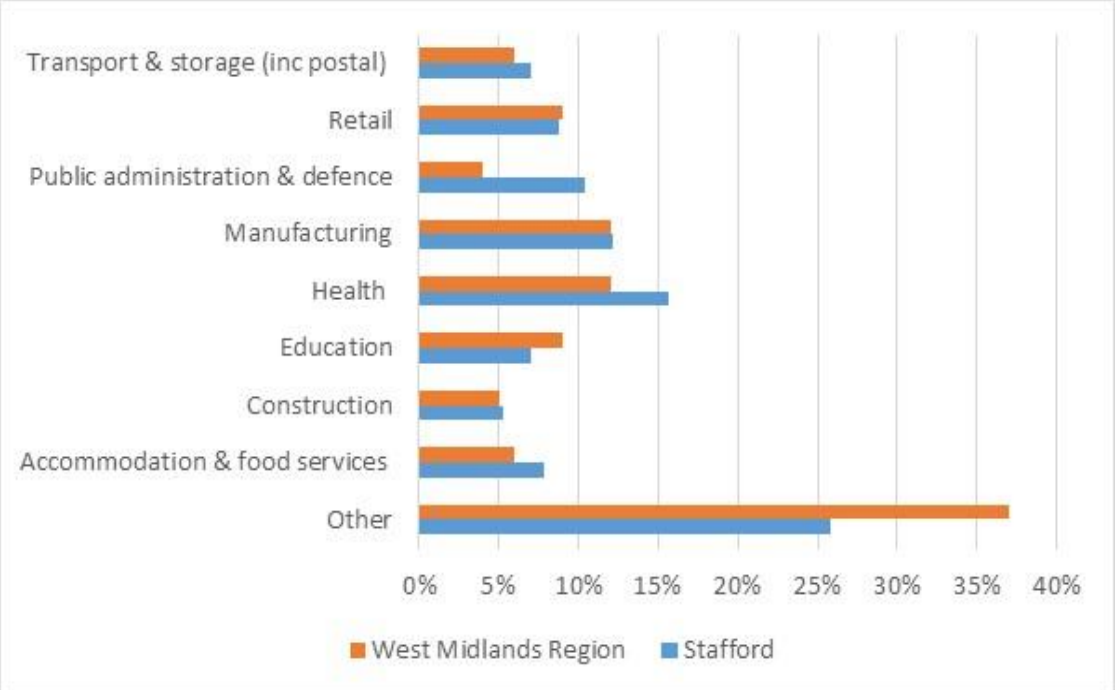
Figure 8: Business sector composition in SBC area and the West Midlands [162]



12.3.4 In 2015[163], approximately 57,000 people worked in the SBC area. According to the Office for National Statistics Business Register and Employment Survey 2015, the top five sectors in terms of share of employment in Stafford were: health (16%), reflecting the ageing population; manufacturing (12%); public administration and defence (10%); retail (9%); and accommodation and food services (8%). These compare with the top five sectors for the West Midlands region, which were: health (12%); manufacturing (12%); retail (9%); education (9%); and business administration and support services (8%). This is shown in Figure 9.

[161] Office for National Statistics; UK Business count –Local Units 2015; https://www.nomisweb.co.uk
[162] "Other" includes: Information & communication; Manufacturing; Wholesale; Transport & storage (including postal); Motor trades; Property; Education; Financial & insurance; Public administration & defence; Mining, quarrying & utilities.
[163] Office for National Statistics; 2015; Business Register and Employment Survey; http://www.nomisweb.co.uk

Figure 9: Employment by industrial sector in the SBC area and the West Midlands [164]



12.3.5 According to the Annual Population Survey (2016)[165], the employment rate[166] within the SBC area was 75% (60,300 people), which is higher than that recorded for both the West Midlands (71%) and England (74%). In 2016, unemployment[167] in the SBC area was 4%, which was lower than the West Midlands (6%) and England (5%).

12.3.6 According to the Annual Population Survey (2016) , 46% of SBC residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 31% in the West Midlands and 38% in England, while 7% of residents had no qualifications, which was lower than that recorded both for West Midlands (12%) and England (8%).

Property

12.3.7 A review of employment land in 2012[168] identified a need for 8.9ha per year to 2026 for general business land in the SBC area. The importance of developing a range of employment sites to support growth has been highlighted in the LEP Strategic Economic Plan[169].

[164] Other' includes Business administration & support services; Professional, scientific & technical; Arts, entertainment, recreation and other services; Wholesale; Motor trades; Information & communication; Property; Financial & insurance; Mining, quarrying & utilities; Agriculture, forestry & fishing.
[165] Annual Population Survey, (2016), NOMIS; Available online at: http://www.nomisweb.co.uk
[166] The proportion of working age (16-64 year olds) residents that is in employment.
[167] 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.
[168] Stafford Borough Council; (2012); Employment Land Review 2012.Based on 10-year average build rate projected forward for 2012-2036.
[169] Stoke-on-Trent and Staffordshire LEP (undated), Stoke-on-Trent & Staffordshire Economic Growth Strategy 2012 - 2026, v2.1; http://www.staffordbc.gov.uk/live/Documents/Forward%20Planning/Examination%20Library%202013/E17--STOKE-ON-TRENT-AND-STAFFORDSHIRE-LOCAL-ENTERPRISE-PARTNERSHIP-ECONOMIC-GROWTH-STRATEGY-2012-2026.pdf

12.3.8 The average vacancy rate for industrial and warehousing property in the SBC area in April 2017 has been assessed as 6% based on marketed space against known stock[170].

Future baseline

Construction (2020)

12.3.9 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2020.

12.3.10 Implementation of all outstanding development consents and land allocations that can be built could result in approximately 6,900 additional jobs by 2020. The existing composition and numbers of employers, employees and economic sectors in the area is likely to change over time in ways that cannot be accurately forecast. These developments are considered in the cumulative assessment of the construction phase of the Proposed Scheme.

Operation (2027)

12.3.11 No additional committed developments have been identified in this area that will materially alter the baseline conditions in 2027 for business receptors.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The draft CoCP[171] includes a range of provisions that will help mitigate socio-economic effects associated with construction within this area, including:

- reducing nuisance through sensitive layout of construction sites (Section 5);
- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding, to reduce impacts on access to and visibility of their premises (Section 12);
- applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses),
- monitor and manage flood risk and other extreme weather events that may affect socio-economic resources during construction (Section 13);
- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (Section 14); and
- maintaining access to businesses for the duration of construction works where reasonably practicable (Section 14).

[170] Vacant space is based on marketed space identified from Estates Gazette data (EGi); stock data is taken from information supplied by the Valuation Office (VOA).
[171] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

Assessment of impacts and effects

12.4.2 The proposed construction works are assessed for socio-economic effects in relation to:

- premises demolished with their occupants and employees needing to relocate to allow for construction of the Proposed Scheme;
- in-combination effects (e.g. air quality, noise, vibration, construction traffic and visual impacts) and isolation of an area, which could affect business operations. Any resulting effects on employment are reported at a route-wide level (see Volume 3, Route-wide effects); and
- potential employment opportunities arising from construction in the local area (including in adjacent community areas).

Temporary effects

In-combination effects

12.4.3 Businesses within the Colwich to Yarlet area may experience air quality, noise and vibration or construction traffic impacts as a result of construction of the Proposed Scheme. Taken in combination, the residual effects from these other topic assessments may amount to a significant change in the environment experienced at the Mayfield Children's Home on Bishton Lane.

12.4.4 Mayfield Children's Home is a specialist residential home for students at Rugeley School located in the Fradley to Colton area (CA1). Due to a high staff to student ratio, the establishment is a relatively large source of employment in the area. All of the children are severely autistic, with many having special behavioural, learning or communication needs in addition. The sensitivity of the establishment is considered to be high, specifically due to locational ties with Rugeley School and the residents' sensitivity to changes in environmental conditions.

12.4.5 Mayfield Children's Home may experience significant noise (for two years) and visual effects (throughout construction) as a result of the proposed construction activities. The Proposed Scheme is assessed to have a significant in-combination effect on this employment site (further details are reported inSection 6, Community).

12.4.6 The resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3, Route-wide effects).

Isolation

12.4.7 No non-agricultural[172] businesses have been identified within the Colwich to Yarlet area that are expected to experience significant isolation effects as a result of the Proposed Scheme.

[172] Possible employment loss in agricultural businesses as a result of the Proposed Scheme has been estimated at the route-wide level.

Construction employment

12.4.8 Construction compounds in the Colwich to Yarlet area will consist of the Trent South embankment main compound and 10 satellite construction compounds. These sites could result in the creation of up to 1,870 person years of construction employment opportunities[173], broadly equivalent to 190 full-time jobs[174], 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 considered as part of the route-wide assessment (see Volume 3, Route-wide effects).

12.4.9 Direct construction employment could also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers. The impact of the indirect construction employment creation has been considered as part of the route-wide assessment (see Volume 3, Route-wide effects).

12.4.10 The resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3, Route-wide effects).

Permanent effects

Businesses

12.4.11 Businesses directly affected, comprising those that lie within land required for the Proposed Scheme, are reported 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 and resources are clustered together.

12.4.12 Twelve business accommodation units or sites in the study area will be directly impacted upon by the Proposed Scheme. These 12 units or sites, together, form six defined resources including Ingestre Park Golf Club, Park Farm Farmhouse Bed and Breakfast, Upper Moreton Farm Rural Activities Community Interest Company[175] and businesses at Middlebank Farm, which include an information technology consultancy office and a dog kennelling business.

12.4.13 Of the six resources identified, only two will experience direct impacts which are categorised as significant effects on business activities and employment, as set out in Table 31.

Table 31: Resources which are categorised as experiencing significant direct effects

Resource	Description of business activity
Staffordshire County Showground	Recreation/ leisure and tourism. Events/ function space
Great Haywood Marina	Recreation/ leisure and tourism. Support to canal based recreational activities.

[173] 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.
[174] Based on the convention that 10 employment years is equivalent to one full time equivalent job.
[175] For details on Upper Moreton Care Farm refer to Volume 2: Section 4, Agriculture, forestry and soils.

Impact magnitude

12.4.14 The magnitude of impact focuses on the number of jobs that will be affected by the Proposed Scheme, either through displacement or possible job loss. It also considers the implications of this impact in relation to the scale of economic activity and opportunity in the area.

Sensitivity

12.4.15 The following was taken into account when considering the sensitivity of resources:

- availability of alternative, suitable premises;
- size of the local labour market;
- skill levels and qualifications of local people; and
- levels of unemployment.

Significance of effects

12.4.16 Taking account of the sensitivity of the resource and the magnitude of impact, the significance of the resultant effects is set out in Table 32.

Table 32: Significance of effects on resources

Resource	Impact magnitude	Sensitivity	Significance of effect
Staffordshire County Showground	Medium	Medium	Moderate adverse - significant
Great Haywood Marina	Medium	Medium	Moderate adverse - significant

12.4.17 The construction of the Hopton South cutting and the A518 Weston Road overbridge will require the demolition of a steel frame outbuilding within the Staffordshire County Showground and the acquisition of land used for car parking. Whilst the main assets within the site will not be impacted upon by the Proposed Scheme, the loss of car parking will potentially impair its ability to attract and retain events or functions. The effect on this resource and its employees is assessed to be moderate adverse and will, therefore, be significant.

12.4.18 Construction of the Great Haywood viaduct piers will require land permanently to the north of the main basin at the Great Haywood Marina. The construction phase will require work to continue for a period of three years, three months. Thereafter, maintenance access will be required beneath the viaduct to the remaining grass amenity area, but this is not anticipated to conflict with use by visitors to the site. For the duration of the construction phase, approximately 20 informal visitor car parking spaces located at the top of the basin will be removed but returned upon completion of works. Construction works may have the effect of discouraging visitor users of the site, reducing its ability to attract custom. The effect on this resource and its employees is assessed to be moderate adverse and will, therefore, be significant.

12.4.19 Across all of the employment areas reviewed, an estimated 100 jobs[176] will either be displaced or possibly lost within the Colwich to Yarlet area. There is a reasonable probability that businesses will be able to relocate to places that will still be accessible to residents within the travel to work areas due to the general availability of vacant premises. However, there may be cases where alternative locations are problematic and the businesses may be unable to relocate on a like-for-like basis within the area. The impact on the local economy from the loss and/or relocation of jobs is considered to be modest compared to the scale of economic activity and employment opportunity in the SBC area (approximately 57,000 jobs).

Other mitigation measures

12.4.20 Due to the loss of car parking potentially lessening its attractiveness to users and exhibitors, the operation of Staffordshire County Showground will be impaired during major events. The operation of the Great Haywood Marina may be impaired as a result of its reduced attractiveness for canal related tourism. HS2 Ltd is continuing to engage with operators of these businesses to identify reasonably practicable measures to mitigate the likely significant effects identified in this assessment.

12.4.21 Businesses displaced by the Proposed Scheme will be compensated in accordance with the Compensation Code. HS2 Ltd recognises the importance of businesses, displaced from their existing premises, being able to relocate to suitable alternative premises and will, therefore, offer additional support over and above statutory requirements to facilitate this process[177].

12.4.22 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents along the line of route in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that promotes further economic growth across the UK.

Summary of likely residual significant effects

12.4.23 Likely significant residual effects are shown in Volume 5: Socio-economic Map Book: Maps SE-01-210b to SE-01-221a.

12.4.24 The Proposed Scheme will result in moderate adverse residual significant effects on the Staffordshire County Showground and the Great Haywood Marina, which may impair the operation of these facilities.

12.4.25 The Proposed Scheme will also result in significant residual in-combination effects on the residents of Mayfield Children's Home during construction which may impair its operation.

12.4.26 HS2 Ltd is continuing to engage with the Staffordshire County Showground, Great Haywood Marina and Mayfield Children's Home to identify reasonably practicable

[176] Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency (HCA) Employment Densities Guide 3rd Edition (2015). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary significantly from actual employment at the sites.

[177] HS2 Phase 2a Information Paper C8: Compensation code for compulsory purchase.

measures to mitigate the residual significant effects associated with the construction of the Proposed Scheme.

Cumulative effects

12.4.27 No committed developments have been identified that are considered to interact with the Proposed Scheme.

12.4.28 Cumulative effects arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are assessed as part of the route-wide assessment (see Volume 3, Route-wide effects).

12.5 Effects arising from operation

Avoidance and mitigation measures

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

Assessment of impacts and effects

Resources with direct effects

12.5.2 There are no resources considered likely to experience significant direct socio-economic effects during the operation of the Proposed Scheme.

In-combination effects

12.5.3 One employer has been identified within the area which is expected to experience significant in-combination effects as a result of the Proposed Scheme.

12.5.4 Mayfield Children's Home on Bishton Lane may experience significant noise (permanent) and visual residual effects (throughout operation) during the operational phase of the Proposed Scheme. The sensitivity of this establishment is considered to be high, specifically as the establishment has locational ties with Rugeley School and residents are considered to be very sensitive to changes in environmental conditions. The Proposed Scheme is assessed to have significant in-combination effects on this employer.

Operational employment

12.5.5 Operational employment will be created at the Stone Infrastructure Maintenance Base – Rail (IMB-R) for maintaining the Proposed Scheme, located within the Stone and Swynnerton area (CA3). It is likely that some of these jobs will be accessed by local residents.

12.5.6 Direct operational employment created by the Proposed Scheme could lead to indirect employment opportunities for local businesses in terms of potentially supplying the Proposed Scheme or benefiting from expenditure of directly employed workers on goods and services.

12.5.7 The impact of operational employment creation has been assessed and reported at a route-wide level in Volume 3, Route-wide effects.

Other mitigation measures

12.5.8 HS2 Ltd is continuing to engage with Mayfield Children's Home to identify reasonably practicable measures to mitigate the significant effects identified at this location.

Summary of likely residual significant effects

12.5.9 Likely significant residual effects are shown on Volume 5: Socio-economic Map Book: Maps SE-01-210b to SE-01-221a.

12.5.10 The Mayfield Children's Home on Bishton Lane will be affected by a combination of noise and visual effects as a result of the operation of the Proposed Scheme which may impair its operation.

Cumulative effects

12.5.11 No cumulative effects on socio-economic characteristics have been identified in the Colwich to Yarlet area during operation.

Monitoring

12.5.12 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

12.5.13 There are no area-specific requirements for monitoring socio-economic effects during the operation of the Proposed Scheme in the Colwich to Yarlet area. Where there are likely residual significant effects at Mayfield Children's Home, the specific operational monitoring requirements in relation to noise and visual effects, which will contribute to the in-combination effect, are described in the relevant topic chapters.

13 Sound, noise and vibration

13.1 Introduction

13.1.1 This section reports the assessment of the likely noise and vibration significant effects arising from the construction and operation of the Proposed Scheme within the Colwich to Yarlet 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[178]; 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'[179].

13.1.2 Engagement with Stafford Borough Council (SBC) has been undertaken with respect to the sound, noise and vibration assessment. The purpose of this engagement has been to obtain relevant information regarding residential and non-residential resources and existing baseline sound levels, and to discuss the development of the mitigation to be included in the Proposed Scheme. SBC officers were also invited to attend and witness the baseline sound measurements being undertaken within this area.

13.1.3 More detailed information regarding the sound, noise and vibration assessment for the Colwich to Yarlet area is available in the relevant appendices in Volume 5:

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000); and
- sound, noise and vibration baseline, construction and operation assessment (Appendix SV-002-002).

13.1.4 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 Map Series CT-10, CT-05 and CT-06 (Volume 2: CA2 Map Book). Mapping to support the sound, noise and vibration assessment is presented in Map Series SV-05 (Volume 2: CA2 Map Book) and Map Series SV-01, SV-02, SV-03 and SV-04 (Volume 5: Sound, noise and vibration Map Book).

13.1.5 The assessment of likely significant effects from noise and vibration on agricultural, community, heritage, ecological and health receptors and the assessment of tranquillity are presented in Section 4, Agriculture, forestry and soils; Section 6, Community; Section 7, Cultural heritage; Section 8, Ecology and biodiversity; Section 9, Health; and Section 11, Landscape and visual of this report respectively.

[178] '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.
[179] Quiet areas are defined in the Environmental Impact Assessment Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity.

13.2 Scope, assumptions and limitations

13.2.1 The approaches to assessing sound, noise and vibration and appropriate mitigation are outlined in Volume 1 (Section 8), the Scope and Methodology Report (SMR), and the SMR Addendum[180].

13.2.2 In this assessment 'sound' is used to describe the acoustic conditions that people experience as a part of their everyday lives. The assessment considers how those conditions may change through time and how sound levels and the acoustic character of an area is likely to be modified through the introduction of the Proposed Scheme. Noise is taken as unwanted sound and hence adverse effects are noise effects and mitigation is, for example, by noise barriers.

13.2.3 Effects can either be temporary from construction or permanent from the operation of the Proposed Scheme. These effects may be direct, resulting from the construction or operation of the Proposed Scheme, and/or indirect, resulting from changes in traffic patterns on existing roads or railways that result from the construction or operation of the Proposed Scheme.

13.3 Environmental baseline

Existing baseline

13.3.1 The Colwich to Yarlet area is characterised by a mix of small towns, villages, hamlets and isolated residential properties in a predominantly rural setting. The sound environment is generally dominated by local and distant road traffic, with trains (on the West Coast Main Line (WCML)), overflying aircraft, local neighbourhood sources and natural and agricultural sounds also contributing.

13.3.2 There are several main roads within the Colwich to Yarlet area including, the A51 Lichfield Road that runs through Little Haywood, Great Haywood and Pasturefields; the A518 Weston Road which connects Uttoxeter with Stafford; the A34 Stone Road that runs through Yarlet; the A513 Beaconside that connects the A518 Weston Road to the A34 Stone Road and the M6; and the B5066 Sandon Road that runs through Hopton.

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

13.3.4 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for the Colwich to Yarlet area in Volume 5: Appendix SV-002-002.

13.3.5 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration[181]. The predicted vibration levels at all receptors as a result of the Proposed Scheme has, therefore, been assessed using specific

[180] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report and Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.
[181] Further information is available in the Volume 5: Appendix SV-001-000, Sound, noise and vibration methodology, assumptions and assessment report and the Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.

thresholds, below which receptors will not be affected by vibration. Further information is provided in Volume 1 (Section 8).

Future baseline

13.3.6 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth, which may be as a result of local or national trends or due to specific committed developments. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads. On higher speed roads, tyre sound dominates[182] and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

13.3.7 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2020 and 2027. Committed developments involving sound or vibration sensitive uses within the relevant study area have been included within the assessment and are reported for the Colwich to Yarlet area in Volume 5: Appendix SV-002-002. Where applicable, sound, noise or vibration significant effects on these committed developments are discussed in the following sections.

Construction (2020)

13.3.8 The assessment of noise from construction activities assumes a baseline year of 2020, which represents the period immediately prior to the start of the construction period. As a reasonable worst case, it has been assumed that no change in baseline sound levels will occur between the existing baseline year of 2016 and the future baseline year of 2020.

Operation (2027)

13.3.9 The operational assessment is based upon the predicted change in sound levels that result from operation of the Proposed Scheme. The assessment initially considered a worst case (that would overestimate the change in levels) by assuming that sound levels would not change from the existing baseline year of 2016. Where significant effects were identified on this basis, the effects have been assessed using a baseline year of 2027 to coincide with the proposed start of passenger services. The future baseline is the sound environment that would exist in 2027 without the Proposed Scheme. This is presented in Table 14 and Table 15 in Volume 5: Appendix SV-002-002.

[182] Tyre noise typically becomes the dominant sound source for steady road traffic.

13.4 Effects arising during construction

Local assumptions and limitations

Local assumptions

13.4.1 The construction arrangements that form the basis of the assessment are presented in Section 2.3 of this report and in Volume 1 (Section 8).

13.4.2 During certain construction processes, there may be the need to operate fixed construction plant such as generators[183] and water pumps for reasons of safety or engineering practicability on a continuous basis. This equipment will be sited, or locally screened to control sound to neighbouring residential premises.

13.4.3 It is assumed there will be some night-time working during road and rail possession periods and it is expected that the noise effects from these works will be limited in duration and are therefore not considered to be significant. Any noise effects arising from these short-term construction activities will be controlled and reduced by the management processes set out in the draft Code of Construction Practice (CoCP)[184].

13.4.4 The assessment takes account of people's perception of noise throughout the day. More stringent criteria are applied during evening and night-time periods, when people are more sensitive to noise, compared to the busier and more active daytime period.

13.4.5 Piling and vibratory compaction is likely to result in short-term[185] appreciable ground-borne vibration at a small number of dwellings, situated very close to these activities. These receptors will also be exposed to appreciable noise from the construction of the Proposed Scheme. The significance of the identified vibration effects has been assessed in combination with the airborne noise effects also identified at these receptors. The assessment is presented in Volume 5: Appendix SV-002-002.

Local limitations

13.4.6 There are a number of locations in this area where the land or property owners did not permit baseline sound level monitoring to be undertaken at their premises. However, sufficient baseline sound level information has been obtained at neighbouring representative locations to undertake the assessment. Further information is provided in Volume 5: Appendix SV-002-002.

Avoidance and mitigation measures

13.4.7 The assessment assumes the implementation of the principles and management processes set out in the noise and vibration section of the draft CoCP (Section 13), which are:

- best practicable means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA), which will be applied

[183] As required by the CoCP. The use of diesel or petrol-powered generators will be reduced by using mains electricity or battery-powered equipment where reasonably practicable.
[184] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.
[185] Typically less than one month.

during construction activities to minimise noise (including vibration) at neighbouring residential properties;

- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example, the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings;
  - screening: for example, local screening of equipment or perimeter hoarding; and
  - where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary re-housing will be offered in accordance with the HS2 noise insulation and temporary re-housing policy;
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of the CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise, including control of working hours, and provide a further assessment of construction noise and vibration, including confirmation of noise insulation/temporary re-housing provision;
- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to, and be reviewed by, the nominated undertaker and made available to the local authorities; and
- contractors will be required to comply with the terms of the CoCP and appropriate action will be taken by the nominated undertaker as required to ensure compliance.

13.4.8 In addition to this mitigation, to avoid or reduce likely community significant effects, taller screening[186], as described in the draft CoCP, has been assumed at the following locations:

- Tolldish Lane, between the residential properties close to the junction with A51 Lichfield Road and the construction worksite;
- Mount Edge, Hopton between the residential properties and the construction worksite; and
- B5066 Sandon Road, Hopton between the residential properties and the construction worksite.

13.4.9 Noise insulation will be offered for qualifying buildings as defined in the draft CoCP. Noise insulation or, where appropriate, temporary re-housing will avoid residents being significantly affected by levels of construction noise inside their dwellings. The

[186] As described in the draft CoCP, provided by solid temporary hoarding, temporary stockpiles, screening close to activities or other means to provide equivalent noise reductions.

assessment reported in this section provides an estimate of the buildings that are likely to qualify for noise insulation. None are predicted to qualify for temporary rehousing.

13.4.10 Qualification for noise insulation and temporary re-housing will be confirmed, as part of seeking prior consent from the local authority under Section 61 of the CoPA. Qualifying buildings will be identified, as required in the draft CoCP, so that noise insulation can be installed, or any temporary re-housing provided, before the start of the works predicted to exceed noise insulation or temporary re-housing criteria.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

13.4.11 Taking account of the avoidance and mitigation measures set out in the previous paragraphs, the following eight residential properties are forecast to experience noise above the eligibility criteria as defined in the HS2 noise insulation and temporary rehousing policy[187]. These residential dwellings are indicated on Map Series SV-03 (Volume 5: Sound, noise and vibration Map Book):

- 1 – 5 Park Farm Barns,Trent Walk , Stafford (assessment location ref.: 12102 and 12103);
- Park Farm, Trent Walk, Stafford (assessment location ref.: 12103);
- Marston Cottage, Marston, Stafford (assessment location ref.:12184); and
- 2 Marston Cottage Marston, Stafford (assessment location ref.:12184).

13.4.12 For daytime construction, the trigger level for eligibility for noise insulation is 75dB[188] measured outdoors.

13.4.13 The mitigation measures, including noise insulation for the eight residential properties, will reduce noise inside all dwellings such that it does not reach a level where it will significantly affect residents.

Residential receptors: direct effects – communities

13.4.14 The avoidance and mitigation measures to be implemented during construction will avoid airborne construction noise adverse effects on the majority of receptors and communities. Residual temporary noise or vibration effects are identified later in this section. With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

13.4.15 In locations with lower existing sound levels[189], construction noise effects are likely to be caused by changes to noise levels outside dwellings. These may be considered by the local community as an effect on the acoustic character of the area and hence be perceived as a change in the quality of life for that community. These effects are

[187] Further information is provided in HS2 Information Paper E13, Control of construction noise and vibration.
[188] $L_{pAeq,0800-1800}$ measured at the façade.
[189] Further information is presented in Volume 5: Appendix SV-001-000, Sound, noise and vibration methodology, assumptions and assessment report.

considered to be significant when assessed on a community basis taking account of the local context.

13.4.16 The temporary adverse effects on the residential areas identified in Table 33, including shared open areas, are considered to be significant on a community basis.

Table 33: Direct adverse effects on residential communities and shared open areas that are considered to be significant on a community basis

Significant effect number[190]	Type of significant effect	Time of day	Location	Cause (construction activities)	Assumed approximate duration of impact[191]
CSV02-C01	Construction noise	Daytime	Approximately 10 dwellings at Moreton.	Earthworks, auto-transformer base construction and movement of vehicles on site haul routes. The typical and highest monthly noise levels are approximately 65dB and 70dB[192].	Up to 9 months
CSV02-C02	Construction noise	Daytime	Approximately 15 dwellings on Tolldish Lane, Great Haywood.	Site establishment, earthworks and movement of vehicles (or use) of site haul routes. The typical and highest monthly noise levels are approximately 65dB and 70dB[192].	Up to 1 year and 6 months
CSV02-C03	Construction noise	Daytime	Approximately 10 dwellings on Park Farm, Trent Walk, Stafford.	Earthworks, road works and movement of vehicles (or use) of site haul routes. The typical and highest monthly noise levels of approximately 70dB and 75dB[192].	Up to 3 years
CSV02-C04	Construction noise	Daytime	Approximately 10 dwellings in Hopton to the west and east of the Proposed Scheme.	Demolitions, utilities and earthworks associated with the Hopton South and Hopton North cuttings and Hopton retaining wall and concreting works. The typical and highest monthly noise levels are approximately 65-70dB and 75dB[192].	Up to 1 year
CSV02-C05	Combined construction site and traffic noise	Daytime	Approximately 15 dwellings in Marston	Site establishment / clearance, demolition, earthworks and movement of vehicles (or use) of site haul routes and vehicles on Marston Lane. The typical and highest monthly noise levels of approximately 70dB and 75dB[192].	Up to 1 year and 6 months

13.4.17 SBC has identified a housing allocation identified as Policy Stafford 2 North of Stafford Housing identified on Map SV-05-108 (Volume 2: CA2 Map Book). Currently insufficient information regarding the building configurations, use and layout of this development are available. However, it is likely that the closest properties would be

[190] See CA2 Sound, noise and vibration report, Volume 5: Appendix SV-002-002

[191] At the closest properties in the community.

[192] Equivalent continuous sound level at the facade, $L_{pAeq, 0700-1900}$.

subject to construction noise effects. HS2 Ltd will liaise with the local authority to help the local authority/developer identify appropriate mitigation.

13.4.18 Track laying, power system and signalling installation works are unlikely to result in significant construction noise effects, given the short duration close to any communities and, where included in the Proposed Scheme, the presence of the permanent noise fence barriers.

Residential receptors: indirect effects

13.4.19 Construction traffic is likely to cause adverse noise effects on occupants of residential dwellings adjacent to Hanyards Lane, between the Proposed Scheme and Tixall Road. However, considering the small number of properties adjacent to this route, a likely significant construction traffic noise effect has not been identified.

13.4.20 Construction traffic is likely to cause adverse noise effects on residential receptors along Marston Lane between the route of the Proposed Scheme and the A513 Beaconside. Approximately 10 dwellings located immediately adjacent to the road are forecast to experience a change in road traffic noise levels of around 8dB $L_{pAeq,\ 0700\ -\ 2300}$ during the peak months (further information on traffic is provided in Section 14, Traffic and transport). This is considered to be a likely significant effect on a community basis at the residential dwellings on this road, denoted as CSV02-C05 in Volume 5: Appendix SV-002-002. This temporary adverse effect represents a change in the acoustic character of the area which may be perceived as a change in the quality of life for that community.

13.4.21 Construction traffic is also likely to cause adverse noise effects on residents of dwellings located immediately adjacent to the road along Pirehill Lane / Green Lane between Walton and Whitgreave. The majority of the route is located within the Stone and Swynnerton area (CA3) and this effect is discussed within Volume 2: Community area 3, Stone and Swynnerton.

Non-residential receptors: direct effects

13.4.22 The assessment has identified the following non-residential receptors where the predicted airborne sound levels exceed both the relevant impact screening criteria and the noise change criterion (a change of greater than 3dB compared with the existing baseline sound level). These locations are identified in the Colwich to Yarlet area, as shown in Map Series SV-03 (Volume 5: Sound, noise and vibration Map Book):

- Upper Moreton Farm, Bishton Lane, Stafford (assessment location ref.: 12002(N));
- Mayfield Children's Home, Moreton House, Bishton Lane, Stafford (assessment location ref.: 12008(N));
- Park Farm Farmhouse (assessment location ref. 8438(N);
- St. Peter's Church, Hopton (assessment location ref.: 12150(N)); and,
- St. Leonard's Church, Marston (assessment location ref.: 12194(N)).

13.4.23 At each of the non-residential receptors identified above an assessment has been undertaken to determine if this impact would result in a significant effect, using the significance criteria set out in Annex A of Volume 5: Appendix SV-001-000.

13.4.24 Upper Moreton Farm comprises a farmhouse[193], a classroom and outdoor activity areas which provide, amongst other things, rural activities for individuals who have a learning disability/difficulty. The classroom has been assessed against the education facility criteria, and the outside activity areas against the external amenity criteria. The highest predicted daytime monthly construction noise level is 3dB(A) above the screening criteria defined in the SMR for educational use[194] for a period of 21 months. The typical monthly daytime construction noise level is below the screening criteria defined in the SMR. The highest and typical monthly construction noise levels are below the screening criteria for external amenity spaces defined in the SMR[195]. Upper Moreton Farm is identified, on a precautionary basis, as being subject to a likely significant adverse effect (denoted by CSV02-N01 in Table 7 Appendix SV-002-002 (Volume 5)).

13.4.25 Mayfield Children's Home, which operates from Moreton House, is a children's home providing permanent accommodation[196] and external amenity spaces. Moreton House is located to the north of the land required for the construction of the Proposed Scheme, with an access road and gardens located in-between. The windows on the southern façade are single glazed sash windows. Some secondary glazing is present, however, the building relies on opened windows for ventilation. The typical and highest predicted daytime monthly construction noise levels at this building are 6dB(A) and 10dB(A) respectively above the screening criteria defined in the SMR for this use[197]. In its capacity as Mayfield Children's Home, Moreton House is identified, on a precautionary basis, as being subject to a likely significant adverse effect (denoted by CSV02-N02 in Table 7 of Volume 5: Appendix SV-002-002. In addition, Moreton House is a Grade II listed building and the impact on setting of the building as a heritage asset from sound, noise and vibration is considered in the heritage assessment in Section 7, Cultural heritage.

13.4.26 Park Farm Farmhouse provides bed and breakfast accommodation, together with temporary caravan facilities. Park Farm Farmhouse comprises a three-storey brick building with openable windows, used to provide ventilation, and is located to the north of the Proposed Scheme. The construction noise assessment at this receptor is based upon those of a hotel as it provides short term living accommodation. The typical and highest predicted daytime monthly construction noise level at the building are 8dB(A) and 15dB(A) respectively above the screening criteria defined in the SMR for this use[198]. Park Farm Farmhouse is identified, on a precautionary basis, as being subject to a likely significant adverse effect (denoted by CSV02-N03 in Table 7

[193] Considered within the residential assessment.
[194] 50 dB $L_{pAeq,0700-2300}$ (free-field) during the day which is equivalent to 53 dB $L_{pAeq,0700-2300}$ (façade).
[195] Based upon a lower cut off value of 65 dB $L_{pAeq,0700-2300}$ during the day (façade).
[196] During construction this resource has been assessed against the G4 building type screening values, as defined in Volume 5: Appendix SV-001-000
, which are more onerous than would be considered for the assessment of a residential property. This approach has been adopted given the particular sensitivities of the building occupants.
[197] 50 dB $L_{pAeq,0700-2300}$ (free-field) during the day which is equivalent to 53 dB $L_{pAeq,0700-2300}$ (façade).
[198] 50 dB $L_{pAeq,0700-2300}$ during the day (free-field) which is equivalent to 53 dB $L_{pAeq,0700-2300}$ during the day (façade).

Appendix SV-002-002 (Volume 5)). Park Farm has also been assessed as a residential dwelling (assessment location ref.: 12102).

13.4.27 St. Peter's Church, Hopton, constructed in 1876, is a brick building with single glazed windows. Noise level predictions have been made based on the façade facing the route of the Proposed Scheme, which contains no windows. Noise levels at façades with windows are predicted to be lower than the presented sound levels. The highest predicted daytime monthly construction noise level is 3dB(A) above the screening criteria defined in the SMR for this use[199] for a period of 9 months. The typical monthly daytime construction noise level is below the screening criteria defined in the SMR. In this situation, the construction noise levels at façades with windows are likely to be close to or below the screening criteria. On this basis a likely significant effect is not identified at St. Peter's Church, Hopton.

13.4.28 St. Leonard's Church, Marston is a Grade II Listed building. The church, constructed in 1300, includes stained glass windows which were fitted around 1900. The main entrance of the church faces the Proposed Scheme. Currently the church only holds services on Sunday mornings which is outside of the anticipated construction work times for the nearby sites and therefore a likely significant construction noise effect is not identified at St. Leonard's Church.

Non-residential receptors: indirect effects

13.4.29 Construction traffic is likely to cause an adverse noise effect on St. Leonard's Church, Marston which is located adjacent to Marston Lane. Increases in road traffic noise of around 8dB $L_{pAeq,\ 0700\ -\ 2300}$ from the additional construction vehicles[200], using this route during the peak months are predicted (further information on traffic flows is provided in Section 14, Traffic and transport). However, currently the church only holds services on Sunday mornings which is outside of the anticipated construction work times for the nearby sites and therefore a likely significant indirect airborne noise effect is not identified at St. Leonard's Church.

Summary of likely residual significant effects

13.4.30 The proposed avoidance and mitigation measures will reduce noise inside all individual dwellings from the construction activities such that residents will not be significantly affected[201].

13.4.31 The measures will also reduce the construction noise effects on acoustic character in the majority of residential communities. Despite these measures, the effects on the acoustic character in the following local residential community areas are considered to be significant:

- Moreton
- Tolldish Lane, Great Haywood;
- Park Farm, Trent Walk, Stafford;

[199] 50 dB $L_{pAeq,0700-2300}$ during the day (free-field) which is equivalent to 53 dB $L_{pAeq,0700-2300}$ during the day (façade).
[200] Operatives' vehicles and vehicles delivering and removing materials from site.
[201] Refer to Volume 5: Appendix SV-001-000.

- Hopton to the west and east of the Proposed Scheme; and
- Marston.

13.4.32 Construction traffic on Marston Lane in this area is likely to cause significant noise effects on adjacent residential properties.

13.4.33 On a precautionary basis, noise from specific construction activities has been identified as resulting in significant residual temporary effects on the non-residential buildings at:

- Upper Moreton Farm;
- Mayfield Children's Home, Moreton House; and
- Park Farm Farmhouse.

13.4.34 HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures.

Cumulative effects

13.4.35 This assessment has considered the potential cumulative construction noise effects of the Proposed Scheme and other committed developments[202]. In this area, it is not anticipated that there will be any developments built of sufficient scale at the same time as the Proposed Scheme and accordingly, construction noise or vibration from the Proposed Scheme is unlikely to result in any significant cumulative noise effects.

13.5 Effects arising from operation

Local assumptions and limitations

Local Assumptions

13.5.1 The effects of noise and vibration from the operation of the Proposed Scheme have been assessed based upon the highest likely train flows, considering the service pattern for Monday to Saturday including Phase One and Phase Two services. The expected passenger service frequency for Phase 2a, with both Phase One and Phase Two services operational, are described in Volume 1, (Section 4).

13.5.2 Passenger services will start at or after 05:00 from the terminal stations and in this area, with Phase One and Phase Two in operation will progressively increase to 12 trains per hour in each direction on the main lines with an operating speed of 330kph for 90% of services and 360kph for 10% of services. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after 21:00 and the last service will arrive at terminal stations by 24:00. Further information is presented in Volume 1 (Section 4).

[202] Refer to Volume 5: Appenndix CT-004-000, Planning data.

Avoidance and mitigation measures

13.5.3 The development of the Proposed Scheme has sought to keep the route away from main communities and as low as is reasonably practicable.

Airborne noise

13.5.4 HS2 trains will be quieter than the relevant current European Union specifications, in line with the assumptions made for the HS2 Phase One Environmental Statement (ES). This will include reduction of aerodynamic noise from the pantograph that otherwise would occur above 186mph (300kph) with current pantograph designs, drawing on proven technology in use in East Asia. Overall these measures will reduce noise emissions by approximately 3dB at 225mph (360kph) compared to a current European high speed train. The track will be specified to reduce noise, as will the maintenance regime. Further information is provided in Volume 5: Appendix SV-001-000.

13.5.5 The Proposed Scheme incorporates noise mitigation in the form of landscape earthworks and/or noise fence barriers to avoid or reduce significant adverse airborne noise effects. The assessment has been based on the assumption that noise fence barriers are acoustically absorbent on the railway side and are located 5m from the outer rail.

13.5.6 In the Colwich to Yarlet area, noise barriers have been incorporated into the Proposed Scheme to avoid or reduce adverse effects due to airborne noise at the following communities:

- Moreton;
- Tolldish / Tollish Farm;
- Great Haywood;
- Ingestre;
- Hopton;
- Marston; and
- Yarlet.

13.5.7 The location and height of these noise barriers are shown on Map Series SV-05 (Volume 2: CA2 Map Book).

13.5.8 In practice, barriers may differ from this general assumption while maintaining the required acoustic performance. For example, where noise barriers are in the form of landscape earthworks, they need to be higher above rail level to achieve similar noise attenuation to a noise fence barrier because the crest of the earthwork will be further than 5m from the outer rail.

13.5.9 Noise effects will be reduced in other locations along the route of the Proposed Scheme by landscape earthworks provided to avoid or reduce significant visual effects and engineering structures such as cuttings and safety fences on viaducts (where noise barriers are not required). The location of the landscape earthworks is shown on Map Series SV-05 (Volume 2: CA2 Map Book).

13.5.10 Significant noise effects from the operational static sources such as line-side equipment will be avoided through their design and the specification of noise emission requirements. Further information is presented in Volume 5: Appendix SV-001-000.

13.5.11 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996[203] (the Regulations). The assessment reported in this section provides an estimate of the buildings that are likely to qualify under the Regulations based upon the currently available information. Qualification for noise insulation under the Regulations will be formally identified and noise insulation offered at the time the Proposed Scheme becomes operational. Where noise insulation is required, as well as improvements to noise insulation of windows facing the railway, ventilation will be provided so that windows can be kept closed to protect internal sound levels.

13.5.12 Noise insulation will avoid any residual significant effects on health and quality of life arising inside dwellings taking into account mitigation incorporated into the design of the Proposed Scheme.

13.5.13 Where the noise from the operation of the Proposed Scheme measured outside a dwelling exceeds the Interim Target defined by the World Health Organization (WHO)'s Night Noise Guidelines for Europe[204], residents are considered to be significantly affected by the resulting noise inside their dwelling. The Interim Target is a lower level of noise exposure than the trigger threshold for night noise in the Regulations, i.e. 55dB equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings. The effect on people at night due to the maximum sound level as each train passes has also been assessed[205]. In line with these criteria, where night-time noise levels for the use of new or additional railways or altered roads authorised by the Bill are predicted following the methodology set out in the Regulations to exceed 55dB[206], or the maximum noise level as a train passes exceeds the relevant criteria, noise insulation will be offered for these additional buildings.

13.5.14 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 will be intermittent and its level will vary as the PRoW moves closer to and further from the Proposed Scheme. No significant noise effects have, therefore, been identified on users of PRoW within the Colwich to Yarlet area.

Ground-borne noise and vibration

13.5.15 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

[203] Her Majesty's Stationery Office (1996), The Noise Insulation (Railways and Other Guided Transport Systems) Regulations, London.
[204] World Health Organization (2010), *Night time Noise Guidelines for Europe*.
[205] 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).
[206] Equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

13.5.16 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified four residential dwellings, close to the Proposed Scheme, where noise levels are predicted to exceed the daytime trigger threshold set out in the Regulations[207]. It is, therefore, anticipated that these buildings are likely to qualify for noise insulation under the Regulations. These residential dwellings are indicated on Map Series SV-04 (Volume 5: Sound, noise and vibration Map Book):

- Nos.2, 3 and 4 Park Farm Barns, Trent Walk, Stafford (assessment location ref.: 12102); and
- New Buildings Farm Cottage, B5066 Sandon Road, Hopton (assessment location ref.: 12181).

13.5.17 The assessment has identified ten additional residential buildings close to the Proposed Scheme where the daytime forecast noise level does not exceed the threshold set in the Regulations but the predicted night-time noise level exceeds the World Health Organization's Interim Target of 55dB[206], or the maximum noise level as a train passes exceeds the relevant criteria[205]. It is estimated that these buildings will also be offered noise insulation as described previously in the avoidance and mitigation measures section. These residential dwellings are indicated on Map Series SV-04 (Volume 5: Sound, noise and vibration Map Book):

- Rosemary Cottage, Moreton Farm, Bishton Lane, Wolseley Bridge, Stafford (assessment location ref.: 12290);
- The Barn, Moreton Grange, Bishton Lane, Wolseley Bridge, Stafford (assessment location ref.: 12004);
- The Boskins, Bishton Lane, Wolseley Bridge, Stafford (assessment location ref.: 12004);
- Moreton Grange Farmhouse, Bishton Lane, Wolseley Bridge, Stafford (assessment location ref.: 12004);
- Nos 1 and 5 Park Farm Barns, Trent Walk, Stafford (assessment location ref.: 12103);
- Park Farm, Trent Walk, Stafford (assessment location ref.: 12103); and
- Bank Top House, Hopton, Stafford (assessment location ref.: 12158).

13.5.18 The mitigation measures, set out in the previous section, including noise insulation, will reduce noise inside all dwellings such that it will not reach a level where it will significantly affect residents.

[207] Equivalent to a daytime the free-field level of 65 dB $L_{pAeq,0700-2300}$, and a night-time free-field level of 60 dB $L_{pAeq,2300-0700}$

Residential receptors: direct effects – communities

13.5.19 The proposed mitigation measures in the Colwich to Yarlet area will avoid or reduce adverse effects due to airborne noise on the majority of receptors, and in the following communities:

- Moreton;
- Great Haywood;
- Ingestre;
- Marston; and
- Yarlet.

13.5.20 Taking account of the envisaged mitigation, Map Series SV-05 (Volume 2: CA2 Map Book) shows the long term 40dB[208] night-time sound level contour from the operation of trains on the Proposed Scheme. The extent of the 40dB night-time sound level contour is equivalent to, or slightly larger than, the 50dB daytime contour[209]. In general, below these levels adverse effects are not expected.

13.5.21 Above 40dB during the night and 50dB during the day the community effect of noise is dependent on the baseline sound levels in that area and the change in sound level (magnitude of effect) brought about by the Proposed Scheme. The airborne noise impacts and effects forecast for the operation of the Proposed Scheme are presented on Map Series SV-05 (Volume 2: CA2 Map Book). The changes in noise levels shown on these maps are likely to affect the acoustic character of the area such that taking account of the local context[210], this may be significant when assessed on a community basis[211].

13.5.22 Approximately 25 isolated properties within the area have been identified as being subject to a likely adverse noise effect. These effects are likely to be received as an effect on the acoustic character of the area. However, as the affected properties are spatially remote from larger defined residential areas, are subject to smaller magnitudes of noise effect, or are small in number, the effects are not considered to be significant on a community basis.

13.5.23 In this study area, the direct adverse effects on the acoustic character of the areas of the residential communities identified in Table 34 are considered to be significant on a community basis.

[208] Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$).
[209] With the train flows described in the assumptions section of this CFA Report, the daytime sound level (defined as the equivalent continuous sound level from 07:00 to 23:00 or $L_{pAeq,day}$) from the Proposed Scheme would be approximately 10dB higher than the night-time sound level. The 40dB contour therefore indicates the distance from the Proposed Scheme at which the daytime sound level would be 50dB.
[210] Further information is provided in Volume 5: Appendices SV-001-000 and SV-002-002.
[211] Further information is contained in Volume 1.

Table 34: Direct adverse effects on residential communities and shared open areas that are considered significant on a community basis

Significant effect number[212]	Source of significant effect	Time of day	Location and details
OSV02-C01	Airborne noise increase from new train services	Daytime and night-time	Moreton Approximately 10 dwellings in the vicinity of Moreton / Bishton Lane. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the properties. There are no shared open spaces identified as being affected in this community.
OSV02-C02	Airborne noise increase from new train services	Daytime and night-time	Tolldish Farm Approximately 10 dwellings in the vicinity of Tolldish Farm on Tolldish Lane. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the properties. There are no shared open spaces identified as being affected in this community.
OSV02-C03	Airborne noise increase from new train services	Daytime and night-time	Great Haywood/Ingestre Approximately 10 dwellings in the vicinity of Ingestre Park Road and Hoo Mill Lane. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the properties. There are no shared open spaces identified as being affected in this community.
OSV02-C04	Airborne noise increase from new train services	Daytime and night-time	Tixall Approximately 20 dwellings in the vicinity of Tixall Farm and Tixall Court. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around Tixall Manor Farm. The effect on the acoustic character of residential areas at close to Tixall Court would be moderate adverse. There are no shared open spaces identified as being affected in this community.
OSV02-C05	Airborne noise increase and vibration from new train services	Daytime and night-time	Park Farm, Trent Walk, Stafford Approximately 10 dwellings at Park Farm on Trent Walk, Stafford. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the properties, and moderate adverse groundborne-vibration effect. There are no shared open spaces identified as being affected in this community.
OSV02-C06	Airborne noise increase from new train services	Daytime and night-time	Hopton Approximately 80 dwellings on Battle Ridge, Kings Drive, Lower Lane, Wilmore Hill Lane, Hopton Hall Lane and Hopton Lane and their shared external community spaces. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the properties.
OSV02-C07	Airborne noise increase from new train services	Daytime and night-time	Mount Edge, Hopton. Approximately 25 dwellings on Mount Edge, Spode Avenue and Ridgeway. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the closest properties. The effect on the acoustic character of residential areas that are located further from the railway would be moderate adverse. There are no shared open spaces identified as being affected in this community.

[212] See Map Series SV-05 (Volume 2: CA2 Map Book)

Significant effect number[212]	Source of significant effect	Time of day	Location and details
OSV02-C08	Airborne noise increase from new train services	Daytime and night-time	Marston Approximately 30 dwellings on Marston Lane and Yarlet Lane. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the closest properties. The effect on the acoustic character of residential areas that are located further from the railway would be moderate adverse. There are no shared open spaces identified as being affected in this community.

13.5.24 SBC has identified a housing allocation identified as Policy Stafford 2 North of Stafford Housing on Map SV-05-108 (Volume 2: CA2 Map Book). Currently insufficient information regarding the building configurations, use and layout of this development are available. In the absence of additional mitigation, it is likely that the closest properties would be subject to a major noise effect. HS2 Limited will continue to liaise with the local authority to help the local authority/developer identify appropriate mitigation.

Residential receptors: indirect effects

13.5.25 The assessment of operational noise and vibration indicates that significant indirect effects on residential receptors are unlikely to occur in this area.

Non-residential receptors: direct effects

13.5.26 The assessment has identified airborne sound levels greater than the relevant impact screening criteria and a change of greater than 3dB compared to the existing baseline sound level is identified at the following non-residential receptors in the Colwich to Yarlet area, as shown in Map Series SV-04 (Volume 5: Sound, noise and vibration Map Book):

- Upper Moreton Farm, Bishton Lane, Stafford (assessment location ref.: 12002(N));
- Mayfield Children's Home, Moreton House, Bishton Lane, Stafford (assessment location ref.: 12008(N));
- Park Farm Farmhouse (assessment location ref.: 8438(N) and 8439(N));
- Staffordshire County Showground (assessment location ref.: 12112(N));
- St. Peter's Church, Hopton (assessment location ref.: 12150(N));
- St. Leonard's Church, Marston (assessment location ref.: 12194(N)); and
- Yarlet School (assessment location ref.: 12209(N)).

13.5.27 At each of the non-residential receptors identified, an assessment has been undertaken to determine if this impact would result in a significant effect using the significance criteria for defined in Section A, Appendix SV-001-000 (Volume 5).

13.5.28 Upper Moreton Farm comprises of a farmhouse[213], a classroom and outdoor activity areas which provide amongst other things, rural activities for individuals who have a learning disability/difficulty. The classroom has been assessed against the education facility criteria, and the outside activity areas against the external amenity criteria. A major operational noise effect has been identified at the centre based on the change in operational airborne sound level outside of the receptor of greater than 10dB compared to the future baseline sound level. Operational noise levels at the classroom are predicted to exceed the impact screening criterion for a school of 50dB $L_{pAeq,16hr}$ by 5dB. This means that noise levels inside the classroom are expected to be in excess of appropriate design aims for a classroom when the windows of the classroom are open. Operational noise levels at the outdoor activity areas located close to classrooms are predicted to be equal to the impact screening criterion of 55dB $L_{pAeq,16hr}$ for an external amenity space. Upper Moreton Farm is identified, on a precautionary basis, as being subject to a likely significant adverse effect (denoted by OSV02-N01 on Map Series SV-05 (Volume 2: CA2 Map Book)).

13.5.29 Mayfield Children's Home, operating from the Grade II listed Moreton House, is a children's home providing permanent accommodation[214] and external amenity spaces. A major operational airborne noise effect has been identified at Mayfield Children's Home based on the change in airborne sound level of greater than 10dB compared to the future baseline sound level. The route of the Proposed Scheme will be in a deep cutting (Moreton cutting) approximately 40m from Moreton House. Moreton House is heritage listed and sound, noise and vibration at this location has also been considered in the heritage assessment. Mayfield Children's Home is identified, on a precautionary basis, as being subject to a likely significant adverse effect (denoted by OSV02-N02 on Map Series SV-05 (Volume 2: CA2 Map Book)).

13.5.30 Park Farm Farmhouse provides bed and breakfast accommodation, together with temporary caravan facilities. In this area, a noise fence barrier up to 2m in height above rail level, will be provided along the route of the Proposed Scheme. A major operational airborne noise effect has been identified at Park Farm Farmhouse based on the change in sound level of greater than 10dB compared to the future baseline sound levels. Daytime operational sound levels at the receptor are predicted to exceed the impact screening criteria for hotels of 50dB $L_{pAeq,16hr}$ by 12dB. Night-time operational noise levels are predicted to exceed the impact screening criteria for hotels of 45dB $L_{pAeq,\ 8hr}$ by 7dB. Ground-borne vibration is predicted to exceed the daytime and night-time impact screening criteria[215] for hotels by a factor of five. Considering the magnitude of the impacts and the combined impact from operational noise and ground-borne vibration, Park Farm Farmhouse Bed and Breakfast and Caravan Club is identified, on a precautionary basis, as being subject to a likely significant adverse effect denoted by OSV02-N03 on Map Series SV-05 (Volume 2: CA2 Map Book). The residential element of Park Farm Farmhouse has also been assessed as a residential dwelling (assessment location ref.: 12102).

[213] Considered within the residential assessment.
[214] During operation the residential part of the building is considered in the residential – direct effects assessment and the non-residential assessment.
[215] A vibration dose value of 0.2 VDV_{day} and 0.1 VDV_{night}.

13.5.31 Staffordshire County Showground provides internal and external exhibition spaces and offices. A moderate operational airborne noise effect has been identified at offices at Staffordshire County Showground based on the change in sound level at this location of between 5dB and 10dB compared to the future baseline sound levels. Daytime operational noise levels at the receptor are predicted to exceed the impact screening criteria for offices of 55 dB $L_{pAeq,16hr}$ by 1dB. Assuming an open window, internal noise levels in the office will be 1dB above the screening criteria for an office. Considering the marginal exceedance of the impact screening criteria a likely significant adverse effect has not been identified at offices at Staffordshire County Showground.

13.5.32 St. Peter's Church, Hopton, constructed in 1876, is a brick building with single glazed windows. Noise level predictions have been made based on the façade facing the route of the Proposed Scheme, which contains no windows. Noise levels at façades with windows are predicted to be lower than the presented sound levels. At the façade facing the Proposed Scheme a major operational airborne noise effect has been identified based on the change in sound level of greater than 10dB compared to the future baseline sound levels. Operational noise levels at the church are predicted to exceed the impact screening criterion for a church of 50dB $L_{pAeq,16hr}$ by 2dB. Noise levels at façades with windows are predicted to be lower than the presented sound levels and are likely to be close to or below the relevant impact screening criteria. On this basis a likely significant effect is not identified at St. Peter's Church.

13.5.33 St. Leonard's Church, Marston is a Grade II Listed building. The church, constructed in 1300 includes stained glass windows which were fitted around 1900. The main entrance of the church faces the Proposed Scheme. A major operational airborne noise effect based on the change in sound level outside of the church of greater than 10dB compared to the future baseline sound levels. Operational noise levels at the church are predicted to exceed the impact screening criterion for a church of 50dB $L_{pAeq,16hr}$ by 3dB. Currently the church only holds services on Sunday mornings and operational airborne sound levels at the weekend are likely to be lower than those presented, given that the number of train movements assumed in the assessment are based upon a higher typical weekday train flows. However, St. Leonard's Church is identified, on a precautionary basis, as being subject to a significant adverse effect denoted by OSV02-N04 on Map Series SV-05 (Volume 2: CA2 Map Book).

13.5.34 Yarlet School is a private preparatory school offering places on day or boarding basis. The school is located to the east of the Proposed Scheme and approximately 120m east of the A34 Stone Road (a dual carriageway). A minor operational noise effect has been identified at the school based on the change in noise level outside of the receptor of between 3 and 5dB compared to the future baseline sound levels. Daytime operational noise levels at the receptor are predicted to exceed the impact screening criteria for schools of 50dB $L_{pAeq,16hr}$ by 1dB. Night-time operational noise levels are below the impact screening criteria for of 45dB $L_{pAeq,16hr}$. The screening criteria are defined on a precautionary basis to ensure that more detailed consideration is undertaken where appropriate. In this situation, considering that the existing ambient noise level is characterised by road traffic noise and the magnitude of the impact during the day, a significant effect has not been identified at Yarlet School.

13.5.35 The assessment of effects on non-residential receptors has been undertaken on a reasonable worst case basis. Further information can be found in Volume 5: Appendix SV-002-002.The non-residential receptors, where direct significant effects are likely, are summarised in Table 35.

Table 35: Likely significant noise or vibration effects on non-residential receptors arising from operation of the Proposed Scheme

Significant effect number[216]	Type of significant effect and source	Time of day	Location and details
OSV02-N01	Activity disturbance of pupils in the portable classroom resulting from operational airborne sound.	Daytime	Upper Moreton Farm, Bishton Lane, Stafford
OSV02-N02	Activity disturbance and sleep disturbance of residents of the centre resulting from operational airborne sound.	Day and Night-time	Moreton House, Mayfield Children's Home, Bishton Lane, Stafford
OSV02-N03	Activity disturbance and sleep disturbance or residents of the bed and breakfast and caravan park resulting from operational airborne sound and operational ground-borne vibration.	Daytime and Night-time	Park Farm Farmhouse - Bed and Breakfast and Caravan Club
OSV02-N04	Activity disturbance to people using St. Leonard's Church resulting from operational airborne sound.	Daytime	St. Leonard's Church, Marston

Non-residential receptors: indirect effects

13.5.36 The assessment of operational noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in this area.

Summary of likely residual significant effects

13.5.37 At individual residences, the mitigation measures, including noise insulation, will reduce noise inside all dwellings such that it will not reach a level where it will significantly affect residents, and therefore, no likely residual significant effects are identified.

13.5.38 At the community level, the envisaged mitigation, including landscape earthworks and noise mitigation, described in this chapter, and presented in Map Series SV-05 (Volume 2: CA2 Map Book), will substantially reduce the potential airborne sound impacts and noise effects that would otherwise arise from the Proposed Scheme. Likely residual significant adverse airborne noise effects due to increased noise levels around the following communities have been identified:

- Moreton: occupants of residential properties on Bishton Lane and at Moreton identified by OSV02-C01 on Map SV-05-105b;
- Tolldish Farm: occupants of residential properties on Tolldish Lane identified by OSV02-C02 on Map SV-05-106;
- Great Haywood/Ingestre: occupants of residential properties on Ingestre Park Road and Hoo Mill Lane identified by OSV02-C03 on Map SV-05-106;

[216] See Map Series SV-05 (Volume 2: CA2 Map Book).

- Tixall: occupants of residential properties in the vicinity of Tixall Farm and Tixall Court identified by OSV02-C04 on Map SV-05-106
- Park Farm, Trent Walk, Stafford: occupants of residential properties in the vicinity of Park Farm and Trent Walk identified by OSV02-C05 on Map SV-05-107;
- Hopton: occupants of residential properties and shared community space in the vicinity of Battle Ridge, Kings Drive, Lower Lane, Wilmore Hill Lane, Hopton Hall Lane and Hopton Lane identified by OSV02-C06 on Map SV-05-107;
- Mount Edge, Hopton: occupants of residential properties on Mount Edge, Spode Avenue and Ridgeway Close identified by OSV02-C07 on Map SV-01-108; and,
- Marston: occupants of residential properties on Marston Lane and Yarlet Lane identified by OSV02-C08 on Map SV-01-108.

13.5.39 The assessment has identified a likely significant airborne noise effect at the following non-residential receptors, identified in Map Series SV-05 (Volume 2: CA2 Map Book):

- Upper Moreton Farm identified by OSV02-N01 on Map SV-05-105b;
- Moreton House - Mayfield Children's Home identified by OSV02-N02 on Map SV-05-105b; and,
- St. Leonard's Church identified by OSV02-N04 on Map SV-05-108.

13.5.40 The assessment has identified a likely significant airborne noise and vibration effect at Park Farm Farmhouse identified by OSV02-N03 on Map SV-05-107 identified in Map Series SV-05 (Volume 2: CA2 Map Book)

13.5.41 HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures.

Cumulative effects

13.5.42 It is not anticipated that there will be any significant cumulative noise effects during operation of the Proposed Scheme.

Monitoring

13.5.43 Volume 1 (Section 9) sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

13.5.44 Operational noise and vibration monitoring will be carried out at different times during the lifetime of the Proposed Scheme at a combination of carefully selected monitoring locations including: adjacent or attached to moving vehicles, at fixed positions or in the vicinity of individual assets; and locations within the surrounding areas and communities alongside the railway corridor.

13.5.45 The expected noise and vibration performance of the Proposed Scheme, operational noise and vibration measurement data, associated asset information, description of

corrective actions, results of measured performance compared to expected conditions, and monitoring reports will be shared with the relevant local authorities at appropriate intervals.

14 Traffic and transport

14.1 Introduction

14.1.1 This section describes the likely impacts on all forms of transport and the consequential significant effects on transport users arising from the construction and operation of the Proposed Scheme through the Colwich to Yarlet area. The effects on traffic and transport are assessed quantitatively, based on existing baseline traffic conditions and future scenarios.

14.1.2 Engagement with Highways England and Staffordshire County Council (SCC) has been undertaken. An important focus of this engagement has been to obtain relevant baseline information.

14.1.3 A detailed report on traffic and transport impacts and surveys undertaken within the Colwich to Yarlet area is contained in Volume 5: Appendix TR-001-000: Transport Assessment.

14.1.4 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

14.1.5 Maps showing traffic and transport significant effects during construction (Map Series TR-03) and operation (Map Series TR-04) and construction traffic routes to compounds (Map Series TR-08) can be found in Volume 5: Traffic and transport Map Book.

14.1.6 In addition, further traffic survey data is set out in Background Information and Data (BID)[217], (see BID-TR-001-000: Traffic assessment baseline data).

14.2 Scope, assumptions and limitations

14.2.1 The scope, key assumptions and limitations for the traffic and transport assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR[218]) and the SMR Addendum[219].

14.2.2 The study area for traffic and transport includes all roads affected by the Proposed Scheme including: the M6; the A51 Lichfield Road as it passes through Great Haywood; the A518 Weston Road as it passes the Staffordshire County Showground; the B5066 Sandon Road; the A513 Beaconside through Stafford; the A34 Stone Road; and local roads serving the settlements of Colwich, Little Haywood, Great Haywood, Tixall, Ingestre, Hixon, Hopton, Marston and Yarlet.

14.2.3 The baseline forecast traffic flows for the future years of assessment have been derived using the Department for Transport's (DfT) traffic forecasting tool, Trip End Model Presentation Program (TEMPro), relevant traffic models (Highways England M6 J13-J15 Smart Motorways Project (SMP) Strategic Model) and model data

[217] HS2 Ltd (2017), High Speed Two (HS2) Phase 2a (West Midlands - Crewe), Background Information and Data, Available online at: www.gov.uk/hs2
[218] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[219] Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

provided by SCC from the Stafford Strategic SATURN Model. The assessment covers the average weekday morning (08:00-09:00) and evening (17:00-18:00) peak periods.

14.2.4 Since it is not possible to forecast how services may change in the future, it has been assumed that bus services for the future years of assessment will be the same as those currently operating.

14.2.5 Forecast future year traffic flows with and without the Proposed Scheme have been based on an approach that does not take account of wider effects such as redistribution and reassignment of traffic. It is unlikely that these wider changes would affect the conclusions drawn in this section.

14.3 Environmental baseline

Existing baseline

14.3.1 Existing conditions in the study area have been determined through site visits, traffic and transport surveys, liaison with Highways England and SCC (including provision of information on public transport, public right of way (PRoW) and accident data) and desktop analysis.

Surveys

14.3.2 Traffic surveys, comprising automatic traffic counts, junction turning counts and queue surveys, of roads crossing the route of the Proposed Scheme or potentially affected by the Proposed Scheme were undertaken in: November and December 2015; February, March, July and November 2016; and March and April 2017. This data has been supplemented by existing traffic data from other sources where available, including from Highways England and SCC. Assessment of the data indicates that the peak hours in the area are 08:00 – 09:00 and 17:00 – 18:00.

14.3.3 PRoW surveys were undertaken in May, June, July and November 2016 and April 2017 to establish their nature and usage by non-motorised users (pedestrians, cyclists and equestrians). The surveys included all PRoW and roads that will cross the route of the Proposed Scheme, and any additional PRoW and roads that may be affected by the Proposed Scheme. The majority of the surveys were undertaken during the weekend, when usage is expected to be highest, but some were undertaken on a weekday where routes may be influenced by commuting or other localised uses.

Highway network

14.3.4 The M6 is the only strategic road that runs through the Colwich to Yarlet area. The M6 runs along a north-south alignment through the north-west section of the area. Junction 14 of the M6 is located to the west of the area.The Proposed Scheme will not intersect the M6 in the Colwich to Yarlet area.

14.3.5 There are three primary 'A' roads in the Colwich to Yarlet area, these are: the A34 Stone Road, which connects Stafford to Stone; the A51 Lichfield Road, which connects Stone with Rugeley via Little Haywood, Great Haywood and Sandon; and the A518 Weston Road, which connects Uttoxeter with Stafford. The strategic and primary road network, particularly around Stafford, can get busy at peak times and delays can be experienced.

14.3.6 The main local roads that will be affected by the Proposed Scheme are the A513 Beaconside and B5066 Sandon Road. The A513 Beaconside connects Stafford to Rugeley, passing through the village of Milford and the northern part of Cannock Chase. The B5066 Sandon Road follows a north to south alignment and connects the A513 Beaconside, in Stafford, with the A51 Lichfield Road, near the village of Sandon. The road also passes through the smaller settlements of Hopton and Salt. The local road network in this area generally operates well although some localised delays can be experienced particularly at peak times.

14.3.7 Relevant accident data for the road network subject to assessment has been obtained from SCC. Data for the period 2012-2015[220] has been assessed and any identified clusters have been examined. Two accident clusters were identified within the Colwich to Yarlet area, at the A513 Beaconside/A34 Stone Road roundabout (nine accidents in the last three years, including one fatality) and at the A34 Lichfield Road/Riverway junction (12 accidents in the last three years, but with no serious casualties or fatalities).

14.3.8 The Proposed Scheme will cross eight roads and roadside footways within the Colwich to Yarlet area, these are: Tolldish Lane; the A51 Lichfield Road; Ingestre Park Road; the A518 Weston Road; Hopton Lane; the B5066 Sandon Road; Marston Lane; and the A34 Stone Road. The Proposed Scheme will also cross Hoo Mill Lane and Trent Walk, which are both private accesses.

Parking and loading

14.3.9 The Staffordshire County Showground is located in the Colwich to Yarlet area. The Showground has 160 marked parking spaces adjacent to the Member's Pavilion including six disabled spaces. The overall site has parking provision for up to 4,000 cars in mainly unmarked spaces.

14.3.10 Great Haywood Marina is located to the west of Great Haywood village. The marina has 23 marked parking bays, including two designated bays, adjacent to the main marina building. The marina also provides parking provision for approximately 100 vehicles in mainly unmarked spaces around the perimeter of the site.

Public transport network

14.3.11 There are four bus corridors that cross the route of the Proposed Scheme in the Colwich to Yarlet area. These are: the A51 Lichfield Road between Rugeley and Stone; the A518 Weston Road between Stafford and Weston; the A34 Stone Road between Stafford and Rugeley; and the B5066 Sandon Road between Stafford and Sandon. The services that cross the route of the Proposed Scheme in each corridor are:

- the A51 Lichfield Road is served by four bus services, the 15, 827, 841/841A and 842, which provide connections to Stafford, Uttoxeter, Great Haywood, Little Haywood, Weston and Hixon;
- the A518 Weston Road is served by two bus services, the 827 and 842, which provide connections to Weston, Hixon, Stafford, Rugeley and Brereton;

[220] 2015 was the last full year of data available at the time of undertaking the assessment.

- the A34 Stone Road is served by one bus service, the 101, which provides connections to Stoke-on-Trent, Yarlet and Whitgreave; and
- the B5066 Sandon Road is served by two bus services, the 15 and 842/842A, which provide connections to Hopton, Salt and Sandon.

14.3.12 There are bus stops located to serve the main built-up areas. Where bus stops are expected to be affected by either the construction or operation of the Proposed Scheme, these are referred to in the relevant assessment sections.

14.3.13 The route of the Proposed Scheme will cross the Macclesfield to Colwich Line to the north of the A51 Lichfield Road.

14.3.14 National and local rail services are accessible via Stafford Station. Stafford Station provides connections to national destinations including London, Manchester, Glasgow, and Birmingham.

Non-motorised users

14.3.15 There are pedestrian footways adjacent to many of the roads in the built up areas of Colwich, Little Haywood, Great Haywood, and Weston. Footways vary in width and condition within these areas. Where there is no formal footway provision adjacent to a road, non-motorised user numbers are generally low.

14.3.16 The route of the Proposed Scheme will cross the existing route of 16 PRoW, including seven bridleways in the Colwich to Yarlet area. A further nine PRoW in the area will be affected either temporarily or permanently due to, for example, temporary diversion of PRoW during construction and permanent upgrades for maintenance access to the Proposed Scheme. The surveys undertaken to inform the assessment showed that there were fewer than 10 people a day recorded on most of the PRoW in the area. The route with the greatest usage was Colwich Footpath 63, which forms part of the Trent and Mersey Canal towpath adjacent to Great Haywood Marina, with 131 users observed during the survey day.

14.3.17 In the areas of Colwich and Little Haywood, the Trent and Mersey Canal towpath running adjacent to the south of Main Road provides an off-road cycle route. This route continues along the canal towpath and through Great Haywood, providing a traffic-free route to Stafford, Rugeley and Aston-by-Stone. In the areas of Yarlet and Marston, there are a number of advisory cycle routes[221] including Whitgreave Lane, Green Lane and March Lane. In addition, National Cycle Network Route 5 will be intersected by the route of the Proposed Scheme at Marston Lane.

Waterways and canals

14.3.18 There are two navigable waterways in the Colwich to Yarlet area, the Trent and Mersey Canal and the Staffordshire and Worcestershire Canal. Great Haywood Marina is located between the Proposed Scheme and Great Haywood village and has capacity for up to 200 boats.

[221] Advisory cycle routes are promoted local routes for use by cyclists that do not generally have any formal cycle infrastructure provision, such as cycle lanes.

Air transport

14.3.19 There is no relevant air transport in the Colwich to Yarlet area. Consequently, this topic is not considered further in this assessment.

Future baseline

14.3.20 The future baseline traffic volumes have been calculated by applying growth factors derived from TEMPro for the future years of 2023, 2027 and 2041. These represent the construction assessment year (2023), the year of opening (2027) and future assessment year (2041). Growth factors from TEMPro have been checked to ensure that committed developments and growth forecasts from the M6 J13-J15 SMP Strategic Model and the Stafford SATURN Model are appropriately reflected.

14.3.21 The committed development at Land off the A34 North Redhill, Stafford (reference: 12/17038/OUT) is not included in TEMPro and has consequently been added into the growth forecasts for this assessment.

14.3.22 Committed transport schemes are also included in the future baseline. In this area, of relevance is the smart motorway improvements on the M6 between junctions 13 and 15 (scheduled start of works March 2018 and scheduled completion of works March 2022), Beaconside Urban Boulevard and Redhill roundabout (proposed signalisation), Stafford Eastern Distributor Road (between the A513 Beaconside and St. Thomas Lane), and Stafford Northern Perimeter Road. These local transport improvements are all planned for completion by 2023, the construction assessment year.

Construction (2023)

14.3.23 Construction of the Proposed Scheme is expected to commence in 2020 with construction activity continuing to 2027 (although activity in 2027 will be limited to testing and commissioning). Construction activities have been assessed against 2023 baseline traffic flows, irrespective of when they occur during the construction period. The year 2023 has been adopted as a common base year and the impact of individual or overlapping activities are considered against this single year. The year 2023 broadly represents the likely peak period during construction of the Proposed Scheme and is therefore considered to be reasonably representative.

14.3.24 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 9% by 2023 compared to the baseline year of 2016.

Operation (2027 and 2041)

14.3.25 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 13% by 2027 compared to the baseline year of 2016.

14.3.26 Future baseline traffic volumes in the peak hours are forecast to grow by an average of 25% by 2041 compared to the baseline year of 2016.

14.4 Effects arising during construction

Avoidance and mitigation measures

14.4.1 The following measures are proposed to avoid or reduce effects on transport users:

- new highways (roads and PRoW) will be constructed and operational prior to the permanent closure of any existing highways, insofar as reasonably practicable;
- the majority of roads crossing the route of the Proposed Scheme will be maintained or locally diverted during construction to limit the need for diversions of traffic onto alternative routes;
- traffic management measures will be implemented to limit any disruption;
- road closures will be restricted to overnight and weekends, insofar as reasonably practicable;
- temporary alternative routes for PRoW will be provided during construction, insofar as reasonably practicable, where either the existing or final proposed route is not available;
- insofar as reasonably practicable, site haul routes will be created adjacent to the route of the Proposed Scheme to transport construction materials and equipment to reduce heavy goods vehicle (HGV) movements on public roads with access taken via the main road network;
- HGVs will be routed, insofar as reasonably practicable, along the strategic and/or primary road network;
- insofar as reasonably practicable, the use of the local road network will be limited to use for site set-up, access for surveys and on-going servicing (including refuse collection and general deliveries to compounds) during construction;
- a temporary railhead will be provided near to Stone in the Stone and Swynnerton area (CA3) to allow construction materials, including excavated materials, and equipment to be transported by the existing rail network. The temporary railhead will include direct access to and from the M6, which will reduce HGV movements on the local road network;
- the reuse of excavated material, insofar as reasonably practicable, along the route of the Proposed Scheme;
- borrow pits in the Fradley to Colton area (CA1), Whitmore Heath to Madeley area (CA4) and South Cheshire area (CA5) will limit the volume of construction traffic on the road network;
- highway measures including junction improvements, passing places and carriageway widening will be provided, as required, to manage the safe passing of construction vehicles on construction HGV routes. These are considered in this assessment and Volume 4: Off-route effects;
- the draft Code of Construction Practice (CoCP)[222] includes the requirement to develop local traffic management plans which will consider the local traffic

[222] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

management strategy including consideration of sensitive receptors, such that the effect on safety and accidents is not significant; and

- on-site welfare facilities will be provided to reduce daily travel by site workers.

14.4.2 Section 14 of the draft CoCP includes measures whose purpose is to reduce the impacts and effects of deliveries of construction materials and equipment, including where appropriate timing of site operations and timing of traffic movements.

14.4.3 The number of private car trips to and from the construction compounds (both workforce and visitors) will be reduced by encouraging alternative sustainable modes of transport or vehicle sharing. This will be supported by an overarching framework travel plan that will require construction workforce travel plans[223] to be produced that will include a range of potential measures to mitigate the impacts of traffic and transport movements associated with construction of the Proposed Scheme.

14.4.4 The measures in the draft CoCP include controls on vehicle types, hours of site operation and routes for HGVs to reduce the impact of road-based construction traffic. In order to achieve this, general and site specific traffic management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads and PRoW affected by the Proposed Scheme.

14.4.5 Site staff and workers will generally arrive before the morning peak hour and depart after the evening peak hour.

14.4.6 Disruption to rail passengers and freight movements on the conventional railway will be reduced insofar as reasonably practicable through the use of measures such as:

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

Assessment of impacts and effects

Temporary effects

14.4.7 The following section considers the impacts on traffic and transport and the likely consequential significant effects resulting from construction of the Proposed Scheme.

Key construction transport issues

14.4.8 The traffic and transport impacts during the construction period within the Colwich to Yarlet area will include:

[223] Construction and operational travel plans will promote the use of sustainable transport modes as appropriate to the location and types of trip. They will include measures such as: provision of information on and promotion of public transport services; provision of good cycle and pedestrian facilities; liaison with public transport operators; promotion of car sharing; and the appointment of a travel plan coordinator to ensure suitable measures are in place and are effective.

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

14.4.9 The construction assessment has also considered any impacts in the Colwich to Yarlet area that arise from construction of the Proposed Scheme in the adjoining community areas.

14.4.10 Construction vehicle movements required to construct the Proposed Scheme will include the delivery of plant and materials, movement of excavated materials and site worker trips. Works will include utilities diversions, earthworks, underpass, viaduct, bridge and highway construction.

14.4.11 Details of construction compounds are provided in Section 2.3. The locations of the compounds and the associated access routes are shown in the TR-08 Map Series (Volume 5: Traffic and transport Map Book). Table 36 provides a summary of this along with the transport activity at each compound. For each compound the peak month of activity is the month within which HGV traffic is at its highest for that compound. The busy period is the period during which HGV traffic serving that compound will be greater than 50% of the HGV traffic in the peak month. The average daily combined two-way vehicle trips for the busy period is the lower end of the range shown in the table below. The average daily combined two-way vehicle trips for the peak month is the upper end of the range shown in Table 36.

Table 36: Typical vehicle trip generation for construction sites in the Colwich to Yarlet area

Compound type	Location	Access to/from compound to main road network	Indicative start/set up date	Estimated duration of use (years and months)	Estimated duration of busy period (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
Satellite	Moreton auto-transformer station satellite compound	Bishton Lane and on to the A51 Wolseley Bridge	October 2024	One year and three months	10	57-84	up to 10
Main	Trent South embankment main compound	A51 Lichfield Road, approximately 400m from where the A51 Lichfield Road crosses the route of the Proposed Scheme	January 2021	Six years	6	400-550	204-279
Transfer node	Transfer node associated with Trent South embankment main compound	A51 Lichfield Road	January 2021	Four years and three months	7	N/A	573-805
Satellite compound		Great Haywood Road	January 2021	3 years and 9 months	2	40-55	98-122

Compound type	Location	Access to/from compound to main road network	Indicative start/set up date	Estimated duration of use (years and months)	Estimated duration of busy period (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
	Trent North embankment satellite compound	to Tixall Road, Blackheath Lane and on to the A518 Weston Road	October 2024	Auto transformer station (ATS) - One year and three months	10	57-84	up to 10
Satellite	Brancote South cutting satellite compound	Hanyards Lane for site set-up and servicing, followed by site haul route thereafter to the A518 Weston Road	January 2021	Four years and three months	3	40-55	80-90
Satellite	Hopton South cutting satellite compound	A518 Weston Road	January 2021	Three years and nine months	1	56-77	269-269
Transfer node	Transfer node associated with Hopton South cutting satellite compound	A518 Weston Road	January 2021	Three years and nine months	4	N/A	617-921
Satellite	Hopton North cutting satellite compound	B5066 Sandon Road and on to A513 Beaconside	January 2021	Three years and nine months	3	48-66	99-117
Satellite	Sandon Road auto-transformer station satellite compound	Off Mount Edge diversion to B5066 Sandon Road and on to A513 Beaconside	October 2024	One year and three months	10	57-84	up to 10
Satellite	Marston South embankment satellite compound	Marston Lane for site set up and servicing, followed by site haul route thereafter to A34 Stone Road	January 2021	Three years and nine months	2	32-44	86-111
Satellite	Marston North embankment satellite compound	A34 Stone Road	January 2021	Three years and six months	3	16-22	108-144
Satellite	Yarlet South cutting satellite compound	A34 Stone Road	January 2021	Three years and nine months	1	32-44	120-120
Transfer node	Transfer node associated with Yarlet South	A34 Stone Road	January 2021	Three years and nine months	6	N/A	745-949

Compound type	Location	Access to/from compound to main road network	Indicative start/set up date	Estimated duration of use (years and months)	Estimated duration of busy period (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
	cutting satellite compound						
Satellite	Yarlet express feeder auto-transformer station satellite compound	A34 Stone Road	October 2024	One year and three months	10	57-84	up to 10

14.4.12 Information on the indicative construction programme is provided in Section 2.3 and the construction methodology is summarised in Volume 1 (Section 6). This illustrates how the phasing of activities at different compounds will generally be staggered and that construction activities at individual compounds may not occur over the whole duration presented in Table 36.

14.4.13 Where construction routes serve more than one construction compound, the combined vehicle movements during the busiest period for each section of each route have been assessed.

Highway network

Strategic and local road network traffic

14.4.14 Temporary road or lane closures and associated diversions will be required in a number of locations including: Tolldish Lane; the A51 Lichfield Road; Mill Lane; Ingestre Park Road; Great Haywood Road; the A518 Weston Road; Hopton Lane; and the B5066 Sandon Road. In most cases, these works will be restricted to short-term overnight and/or weekend closures, and are not, therefore, considered significant. Where works are of a longer duration and/or have a significant effect, these are addressed below.

14.4.15 In order to facilitate the realignment of existing major utilities and for construction of the A34 Stone Road overbridge, the A34 Stone Road will be diverted temporarily off-line and a temporary speed restriction of 40mph (65kph) applied through this section with access to existing properties maintained. This temporary diversion is expected to be required for 12 months and will maintain dual-carriageway capacity on the A34 Stone Road. On completion, the A34 Stone Road will be reinstated on its existing alignment, crossing over the route of the Proposed Scheme on the A34 Stone Road overbridge. The temporary diversion will not have a significant effect on traffic flows and delays for vehicle occupants.

14.4.16 In order to undertake the Trent South embankment works, Tolldish Lane will be temporarily diverted to the north of the transfer node associated with the Trent South embankment main compound for a period of approximately two years and nine months. Tolldish Lane will then be diverted to its new permanent alignment on the Tolldish Lane diversion, which runs parallel to the Trent South embankment before forming a junction with the A51 Lichfield Road. The temporary diversion will not have a significant effect on traffic flows and delays for vehicle occupants.

14.4.17 Where site haul routes, created adjacent to the route of the Proposed Scheme, cross the existing road network, traffic control measures will be implemented and could include the provision of temporary signals or roundabouts, which will be removed upon completion of the works. Short-term lane restrictions will be required in some locations to implement access points for construction vehicles. These traffic control measures are not likely to have a significant effect on traffic flows and delays for vehicle occupants.

14.4.18 Construction of the Proposed Scheme is forecast to result in changes in daily traffic flows due to the movement of excavated or fill material and construction vehicles accessing construction compounds and also temporary diversions.

14.4.19 These changes in traffic flow will lead to increases in delays to vehicle users and congestion[224], which are significant, at the following junctions:

- M6 junction 14 – moderate adverse effect;
- A513 Beaconside/A34 Stone Road signals (Redhill roundabout proposed signalisation) – minor adverse effect;
- A513 Beaconside/B5066 Sandon Road priority junction – major adverse effect;
- A513 Beaconside/B5066 Sandon Road signals – major adverse effect;
- A513 Beaconside/Marston Lane – major adverse effect;
- A518 Weston Road/Blackheath Lane roundabout – major adverse effect;
- A518 Weston Road/A513 Beaconside roundabout – major adverse effect;
- A518 Stafford Road/A51 London Road signals – major adverse effect;
- Blackheath Lane/Baswich Lane/Tixall Road signals – major adverse effect; and
- A51 Lichfield Road/Hoo Mill Lane/Church Lane – major adverse effect.

14.4.20 Junction assessments have been undertaken against the peak month flows and include robust assumptions on the level of construction traffic in the peak hours. The temporary effects identified are considered to be the reasonable worst case and HS2 Ltd will continue to work with the relevant highway authorities to manage the impacts at these locations.

14.4.21 Construction of the Proposed Scheme will result in substantial increases in traffic flows (i.e. more than 30% for HGV or all vehicles) in some locations, which can lead to traffic-related severance[225] for non-motorised users from increases in either all traffic (including Proposed Scheme worker trips, LGV and HGV traffic) or HGV traffic. The

[224] In assessing significant effects of traffic changes on congestion and delays, a major adverse effect occurs where traffic flows on a road link will be beyond or very close to capacity with the Proposed Scheme and the increases in traffic due to the Proposed Scheme will be such as to substantially increase queues and delays on a routine basis at peak times. A moderate adverse effect will occur when traffic flows on a road link will be approaching or at capacity with the Proposed Scheme and modest increases in traffic will increase the frequency of queues and more substantial delays. A minor adverse effect occurs when traffic flows on a road link are not generally exceeding capacity with the Proposed Scheme but the increase in flows will result in occasional queues and delays or small increases in existing delays.

[225] In the context of this Traffic and transport section, severance is used to relate to a change in ease of access for non-motorised users due to, for example, a change in travel distance or travel time or a change in traffic levels on a route that makes it harder for non-motorised users to cross. A reference to severance does not imply a route is closed to access.

effect reported below for each road is the most significant traffic-related severance effect for non-motorised users:

- A51 Lichfield Road between the A518 Weston Road and the A460 Wolseley Road – moderate adverse effect as a result of an increase in HGV traffic;
- A518 Weston Road between the Proposed Scheme and the A51 London Road – major adverse effect as a result of an increase in HGV traffic;
- A518 Weston Road between the Proposed Scheme and the A513 Beaconside – major adverse effect as a result of an increase in HGV traffic;
- A513 Beaconside between the A518 Weston Road and the A34 Stone Road – moderate adverse effect as a result of an increase in HGV traffic;
- A34 Stone Road between the A513 Beaconside and Whitgreave Lane – moderate adverse effect as a result of an increase in HGV traffic;
- A34 Stone Road between M6 Junction 14 and the A513 Beaconside – moderate adverse effect as a result of an increase in all traffic;
- B5066 Sandon Road between the Proposed Scheme and the A513 Beaconside – moderate adverse effect as a result of an increase in HGV traffic;
- Great Haywood Road/Tixall Road between Blackheath Lane and the Proposed Scheme – moderate adverse effect as a result of an increase in HGV traffic;
- Hopton Lane between the Proposed Scheme and the B5066 Sandon Road – minor adverse effect as a result of an increase in all traffic;
- Marston Lane between the Proposed Scheme and the A513 Beaconside – moderate adverse effect as a result of an increase in all traffic;
- Hanyards Lane between the Proposed Scheme and Tixall Road – moderate adverse effect as a result of an increase in all traffic; and
- Bellamour Lane between the B5013 Uttoxeter Road and the A51 Main Road – minor adverse effect as a result of an increase in all traffic.

14.4.22 Utilities works have been assessed in detail where they are major and where the traffic and transport impacts from the works separately, or in combination with other works, will be greater than other construction activities arising within the area. Minor utilities works are expected to result in only localised traffic and pedestrian diversions, which will be of short-term duration. No additional significant effects from these minor utilities works are expected. Similarly, other minor works will involve a low level of use of local roads. Such use is not expected to give rise to significant construction traffic impacts.

Accidents and safety

14.4.23 The effect of the Proposed Scheme on accident and safety risks will not be significant. At one junction, the A513 Beaconside/A34 Stone Road roundabout, where there are existing highway safety issues, there will be an increase in congestion. However, the overall change in traffic flow will not be sufficient to raise additional safety concerns.

It is also noted that the junction has a committed transport improvement scheme which will signalise the roundabout (Redhill roundabout proposed signalisation).

14.4.24 There are no further locations where there are both accident clusters and substantial increases in traffic during construction.

Parking and loading

14.4.25 The Proposed Scheme will impact on the parking provision at the Staffordshire County Showground during construction. As the loss of spaces is permanent, this is reported in Section 14.5.

14.4.26 Construction of the Proposed Scheme will impact on parking provision at the Great Haywood Marina. The construction works associated with the Great Haywood viaduct will require the temporary loss of approximately 20 informal parking spaces around the marina for a period of up to three years and three months. This will result in a temporary moderate adverse parking effect, which is significant. The 23 marked parking bays adjacent to the main marina building are unaffected.

Public transport network

14.4.27 The temporary diversion of the A34 Stone Road will require the diversion of the existing bus service on the A34 Stone Road. However, the change in journey time and distance will not have an adverse significant effect on public transport delay.

14.4.28 The diversion may also require the temporary relocation of bus stops on the A34 Stone Road, although as the stops are expected to be relocated in proximity to the existing stops this is not expected to result in an adverse significant effect for users of these bus stops.

14.4.29 The Macclesfield to Colwich Line crosses under the route of the Proposed Scheme at the Great Haywood viaduct. The construction of the Proposed Scheme, in particular to allow for construction of the Great Haywood viaduct, is expected to require a number of rail possessions over a period of up to four years in this area including one weekend possession of up to 54 hours. Disruption to rail users will be reduced by limiting possessions, where reasonably practicable, to existing maintenance periods. Where necessary, rail replacement services will be provided. HS2 Ltd will work with Network Rail and the train operating companies to ensure that any need for additional possessions can be reduced with good planning and communication (including appropriate advance notice). As the possessions are likely to be short term in nature, the effect on delay to rail passengers and freight services will not be significant.

Non-motorised users

14.4.30 The construction works associated with the Proposed Scheme will require the temporary closure or diversion/realignment of PRoW and roads. In most cases, these will be of a short duration and/or distance and therefore will not have a significant severance effect on users.

14.4.31 However, there will be temporary adverse effects, which are significant, on non-motorised users during construction as a result of severance from increased travel distance and/or hindrances such as substantial changes in levels for non-motorised users due to temporary PRoW and road realignments or diversions at:

- Colwich Footpath 26 – moderate adverse effect from increase in distance of up to 800m;
- Tixall Bridleway 0.1628 – minor adverse effect from increase in distance of up to 350m;
- Tixall Bridleway 0.1630(b) – minor adverse effect from increase in distance of up to 400m;
- Marston Footpath 2 – minor adverse effect from increase in distance of up to 450m;
- Marston Bridleway 8 – minor adverse effect from increase in distance of up to 150m;
- Marston Footpath 10 – minor adverse effect from increase in distance of up to 150m;
- Tolldish Lane – minor adverse effect from increase in distance of up to 350m;
- Mount Edge (for equestrians) – minor adverse effect from increase in distance of up to 650m; and
- Hopton Lane (for equestrians) – minor adverse effect from increase in distance of up to 450m.

14.4.32 With the exception of Colwich Footpath 26 and Mount Edge, the changes in travel distance on the PRoW and road realignments or diversion are less than 500m.

Waterways and canals

14.4.33 The Proposed Scheme will cross over the Trent and Mersey Canal on a viaduct at Great Haywood. The construction of the Proposed Scheme will require short closures (approximately 24hrs) of the Trent and Mersey Canal. HS2 Ltd will work with the Canal & River Trust to ensure that any need for closures can be minimised. As the closures will be short term in nature, the effect on users of the waterway and the associated canal towpath will not be significant.

Permanent effects

14.4.34 Any permanent effects of construction have been considered in the assessment of operation for traffic and transport. This is because the impacts and effects of ongoing increases in travel demand and the wider impacts and effects of the operations phase need to be considered together.

Other mitigation measures

14.4.35 HS2 Ltd will work with operators of the Great Haywood Marina to seek to minimise the temporary loss of car parking and to identify opportunities, where reasonably practicable, to mitigate the temporary adverse effect on parking.

14.4.36 The implementation of the draft CoCP in combination with the construction workforce travel plan will mitigate the transport-related effects during construction of the Proposed Scheme.

Summary of likely residual significant effects

14.4.37 The most intensive peak periods of construction for the Proposed Scheme will cause increases in traffic that will from time to time cause significant adverse effects through additional congestion and/or increased delays for road users at: M6 junction 14 (moderate adverse); A513 Beaconside/A34 Stone Road signals (minor adverse); A513 Beaconside/B5066 Sandon Road priority junction (major adverse); A513 Beaconside/B5066 Sandon Road signals (major adverse); A513 Beaconside/Marston Lane (major adverse); A518 Weston Road/Blackheath Lane roundabout (major adverse); A518 Weston Road/A513 Beaconside roundabout (major adverse); A518 Stafford Road/A51 London Road signals (major adverse); Blackheath Lane/Baswich Lane/Tixall Road signals (major adverse); and A51 Lichfield Road/ Hoo Mill Lane/Church Lane (major adverse).

14.4.38 During the construction period there will be increases in traffic which will increase traffic related severance for non-motorised users at: the A51 Lichfield Road between the A518 Weston Road and the A460 Wolseley Road (moderate adverse); the A518 Weston Road between the Proposed Scheme and the A51 London Road (major adverse); the A518 Weston Road between the Proposed Scheme and the A513 Beaconside (major adverse); the A513 Beaconside between the A518 Weston Road and the A34 Stone Road (moderate adverse); the A34 Stone Road between the A513 Beaconside and Whitgreave Lane (moderate adverse); the A34 Stone Road between M6 junction 14 and the A513 Beaconside (moderate adverse); the B5066 Sandon Road between the Proposed Scheme and the A513 Beaconside (moderate adverse); Great Haywood Road/Tixall Road between Blackheath Lane and the Proposed Scheme (moderate adverse); Hopton Lane between the Proposed Scheme and the B5066 Sandon Road (minor adverse); Marston Lane between the Proposed Scheme and the A513 Beaconside (moderate adverse); Hanyards Lane between the Proposed Scheme and Tixall Road (moderate adverse); and Bellamour Lane between the B5013 Uttoxeter Road and the A51 Main Road (minor adverse).

14.4.39 Construction of the Proposed Scheme will have a temporary moderate adverse parking effect upon users of the car parking at Great Haywood Marina.

14.4.40 There will be temporary adverse significant effects due to increased travel distance during construction on non-motorised users of: Colwich Footpath 26 (moderate adverse); Tixall Bridleway 0.1628 (minor adverse); Tixall Bridleway 0.1630(b) (minor adverse); Marston Footpath 2 (minor adverse); Marston Bridleway 8 (minor adverse); Marston Footpath 10 (minor adverse); Tolldish Lane (minor adverse); Mount Edge (minor adverse – for equestrians); and Hopton Lane (minor adverse – for equestrians).

Cumulative effects

14.4.41 The assessment includes the cumulative effects of planned and committed development during construction by taking this into account within the background traffic growth.

14.4.42 The assessment also takes into account Proposed Scheme construction traffic and transport impacts of works to construct the Proposed Scheme being undertaken in neighbouring community areas.

14.5 Effects arising from operation

Avoidance and mitigation measures

14.5.1 The following measures have been included as part of the design of the Proposed - Scheme and will avoid or reduce impacts on transport users:

- reinstatement of most roads on or close to their existing alignments; and
- replacement, diversion or realignment of PRoW.

Assessment of impacts and effects

14.5.2 The following section considers the impacts on traffic and transport and the likely consequential effects resulting from the operational phase of the Proposed Scheme.

Key operation transport issues

14.5.3 The operation and maintenance of the Proposed Scheme will generate a limited number of vehicular trips and the effect will not be significant.

14.5.4 The operational effects are therefore limited to road closures and the permanent diversion and realignment of roads and PRoW.

Highway network

Strategic and local road network traffic

Operation (2027)

14.5.5 The Proposed Scheme will require the permanent widening, diversion or realignment of: Bishton Lane; Tolldish Lane; the A51 Lichfield Road; the A518 Weston Road; Hopton Lane; the B5066 Sandon Road; Mount Edge; Marston Lane; and the A34 Stone Road. The Proposed Scheme will also require the realignment of Hoo Mill Lane between the junction with Great Haywood Road and the Trent and Mersey Canal. The permanent diversions or realignments will increase travel distance for vehicle occupants. The diversions or realignments are less than 1km in length and will not result in any significant effects with regard to increased journey times for vehicle occupants.

14.5.6 The operation of the Proposed Scheme and the permanent diversion or realignment of roads will not substantially change the traffic flows in the area. However, the diversions of Tolldish Lane and Hopton Lane will result in a reduction in traffic on the retained sections of Tolldish Lane and Hopton Lane to the south of the Proposed Scheme. This will result in a minor beneficial effect, which is significant, on traffic related severance for non-motorised users.

14.5.7 The diversion of Tolldish Lane and Hopton Lane will introduce new junctions on the A51 Lichfield Road and the B5066 Sandon Road respectively. These junctions are forecast to operate within capacity. As there will be no substantial changes in traffic congestion, there will be no significant effects with regard to delays on vehicle occupants.

Operation (2041)

14.5.8 The 2041 future operational traffic impacts will not change the effects assessed in 2027 in the Colwich to Yarlet area.

Accidents and safety

14.5.9 The effect on accident and safety risk is not significant as there are no locations in the Colwich to Yarlet area where there are substantial forecast increases in traffic due to the operation of the Proposed Scheme.

Parking and loading

14.5.10 The route of the Proposed Scheme will pass along the southern edge of the Staffordshire County Showground. The Proposed Scheme will not impact the 160 marked parking spaces adjacent to the Member's Pavilion or the six disabled spaces. However, there will be an impact on the car parking located to the west of the A518 Weston Road, where there is parking in unmarked spaces within these fields. It is estimated that the Proposed Scheme will remove approximately 800 spaces, during construction and these spaces will be lost permanently. The Proposed Scheme will also remove an area which is often used as a camping ground during larger events and a permit parking area located to the south-west of the site. This is assessed to be a major adverse effect on parking, which is significant, although, while the showground is in use throughout the year with events on most weekends, the full extent of car parking is only required and used for major shows and events such as the Staffordshire County Show.

Public transport network

14.5.11 The permanent diversion or realignment of the A518 Weston Road and the B5066 Sandon Road will increase travel distances for bus passengers. However, as the diversions or realignments are less than 1km in length, this will not be significant.

14.5.12 There are bus stops located on Hopton Lane and Spode Avenue, which will be affected by the stopping-up of Hopton Lane. The bus stop on Hopton Lane is located adjacent to Hopton Bank (The Green) and bus passengers from the west of the route of the Proposed Scheme will be diverted via a new pedestrian bridge (Hopton and Coton new footpath overbridge). The bus stop located on Spode Avenue is for school services only. School children from the east of the route of the Proposed Scheme will also be able to access the bus stop via the Hopton and Coton new footpath overbridge. The impact of the Hopton Lane stopping-up on the access route to the bus stops for passengers is considered under non-motorised users.

Non-motorised users

14.5.13 The new Hopton and Coton footpath overbridge will connect the Hopton Lane diversion to the east of the route of the Proposed Scheme with the retained section of Hopton Lane to the west of the route. Whilst vehicular traffic using the two sections of Hopton Lane will be diverted via the B5066 Sandon Road, the new overbridge will ensure that there is no adverse significant severance effect on pedestrians, including those accessing the bus stops on either side of the Proposed Scheme.

14.5.14 There will be permanent widening, realignment, diversion or extension of 24 PRoW and nine roads in the Colwich to Yarlet area that will have an impact on travel distances or introduce hindrances such as substantial changes in levels for non-motorised users.

14.5.15 There will be adverse effects, which are significant, on non-motorised users of 10 of these PRoW and roads as a result of severance from increased travel distance and/or hindrances. These are:

- Colwich Footpath 36 – minor adverse effect from increase in distance of up to 350m;
- Colwich Footpath 26 – moderate adverse effect from increase in distance of up to 950m and diversion via an overbridge;
- Colwich Footpath 55 – minor adverse effect from diversion via an underbridge;
- Tixall Bridleway 0.1628 – minor adverse effect from increase in distance of up to 350m;
- Hopton and Coton Footpath 6 – moderate adverse effect from increase in distance of up to 650m;
- Hopton and Coton Bridleway 12 – minor adverse effect from increase in distance of up to 300m and diversion via an overbridge;
- Hopton and Coton Bridleway 16 – minor adverse effect from increase in distance of up to 200m;
- Marston Footpath 2 – minor adverse effect from increase in distance of up to 450m and diversion via an underbridge;
- Tolldish Lane – minor adverse effect from increase in distance of up to 250m and diversion via an underbridge; and
- Hopton Lane (for equestrians) – minor adverse effect from increase in distance of up to 300m and diversion via an overbridge.

14.5.16 With the exception of Colwich Footpath 26 and Hopton and Coton Footpath 6, the changes in travel distance on the PRoW and road realignments or diversion are less than 500m.

14.5.17 Colwich Bridleway 58 starts within Great Haywood village and the route extends in an east/west alignment and terminates at its junction with Colwich Footpath 54, just north of Tithebarn Covert, with no onward route for equestrian users. Users of Colwich Bridleway 58 will benefit from upgrade of a section of Colwich Footpath 55 to bridleway and an onward extension to Tolldish Lane resulting in an overall extension to the bridleway of up to 400m providing a minor beneficial effect, which is significant, for the non-motorised users of the route.

14.5.18 Users of Colwich Bridleway 23 will benefit from the realignment of Colwich Bridleway 23 on a shorter route. There will be a minor beneficial effect, which is significant, for the non-motorised users of the route.

Waterways and canals

14.5.19 The Proposed Scheme will not have a traffic and transport significant effect on the operation of the waterways and canals in the Colwich to Yarlet area.

Other mitigation measures

14.5.20 HS2 Ltd will work with the Staffordshire County Showground and associated businesses to seek to minimise the loss of car parking and to identify opportunities, where reasonably practicable, to mitigate the major adverse significant effect on parking.

Summary of likely residual significant effects

14.5.21 The diversion of Tolldish Lane and Hopton Lane will result in a reduction in traffic on the retained sections of Tolldish Lane and Hopton Lane and minor beneficial effects on traffic related severance for non-motorised users.

14.5.22 The Proposed Scheme will result in a loss of approximately 800 spaces at the Staffordshire County Showground. There will also be loss of an area used as a camping ground and for permit parking. This results in a major adverse effect on parking. Although the site is in regular use, the majority of events should not be affected by the loss of car parking with the impact limited to larger events.

14.5.23 There will be moderate adverse severance effects due to increased travel distance and/or additional hindrances to travel on the non-motorised users of Colwich Footpath 26 and Hopton and Coton Footpath 6.

14.5.24 There will be minor adverse severance effects on the non-motorised users of: Colwich Footpath 36; Colwich Footpath 55; Tixall Bridleway 0.1628; Hopton and Coton Bridleway 12; Hopton and Coton Bridleway 16; Marston Footpath 2; Tolldish Lane; and Hopton Lane (for equestrians).

14.5.25 There will be minor beneficial effects on the non-motorised users of Colwich Bridleway 58 and Colwich Bridleway 23.

Cumulative effects

14.5.26 The assessment includes cumulative effects of planned and committed development during operation, by taking into account background traffic growth in the future baseline.

Monitoring

14.5.27 Volume 1, Section 9 sets out the general approach to environmental monitoring during operation of the Proposed Scheme.

14.5.28 Operational and maintenance traffic will be very limited and there are no stations on the route of the Proposed Scheme. Consequently, no specific monitoring requirements are considered necessary for this topic during operation of the Proposed Scheme.

15 Water resources and flood risk

15.1 Introduction

15.1.1 This section provides a description of the current baseline for water resources and flood risk in the Colwich to Yarlet area. The likely impacts and significant effects of the Proposed Scheme's construction and operation on surface water and groundwater bodies and their associated water resources are assessed. The likely impacts and significant effects of the Proposed Scheme on flood risk and land drainage are also considered.

15.1.2 Engagement has been undertaken with the Environment Agency, Staffordshire County Council (SCC), which is the Lead Local Flood Authority (LLFA) and Severn Trent Water Limited (the local water and sewerage undertaker). The purpose of this engagement has been to obtain relevant baseline information and to discuss issues and potential effects.

15.1.3 Detailed information on the water resources and flood risk issues specific to the Colwich to Yarlet area are contained in the Volume 5 appendices. These comprise:

- Appendix WR-002-002 – Water resources assessment; and
- Appendix WR-003-002 – Flood risk assessment.

15.1.4 Volume 5 also includes a detailed route-wide, stand-alone Water Framework Directive (WFD) compliance assessment (Appendix WR-001-000) and a draft route-wide water resources operation and maintenance manual (Appendix WR-002-000).

15.1.5 Maps showing the location of the key environmental features (Map Series CT-10) and the key construction (Map Series CT-05) and key operational (Map Series CT-06) features of the Proposed Scheme can be found in the Volume 2: CA2 Map Book.

15.1.6 Map Series WR-01, WR-02, WR-03, WR-05 and WR-06, showing details of the water features referred to in this section, are contained in the Volume 5: Water resources and flood risk assessment Map Book.

15.1.7 In addition, detailed hydraulic modelling reports are included in Background Information and Data (BID)[226]

- BID-WR-004-003 - Hydraulic modelling report - Moreton Brook;
- BID-WR-004-004 - Hydraulic modelling report - Stockwell Heath;
- BID-WR-004-005 - Hydraulic modelling report - Great Haywood Viaduct; and
- BID-WR-004-006 - Hydraulic modelling report – Hopton.

15.1.8 Volume 3, Route-wide effects, Water resources and flood risk (Section 16) covers the following at a route-wide level:

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

- the risk to water resources associated with accidents or spillages from trains during operation of the Proposed Scheme;
- a summary of how the Proposed Scheme complies with the statutory requirements of the WFD; and
- route-wide flood risk issues related to application of the Sequential Test and Exception Test in the National Planning Policy Framework (NPPF)[227].

15.2 Scope, assumptions and limitations

15.2.1 The scope, assumptions and limitations for the water resources and flood risk assessment are set out in Volume 1 (Section 8), the Scope and Methodology Report (SMR)[228] and the SMR Addendum[229].

15.2.2 Unless indicated otherwise, the spatial scope of the assessment (the study area) is based upon the identification of surface water and groundwater features within the 1km of the centre line of the route of the Proposed Scheme, as described in Section 2.2 of this report. In the Colwich to Yarlet area, the study area has been extended to include Shugborough Hall Estate and an area of land where road works are proposed along Bishton Lane.

15.2.3 The assessment is based on desk study information, including information provided by consultees and stakeholders, as well as surveys of accessible water features.

15.2.4 Where surveys have not been undertaken due to land access constraints, a precautionary approach has been adopted in the assessments of receptor value and impact magnitude.

15.2.5 Hydraulic modelling has been undertaken of watercourses and key structures within flood risk areas. This includes modelling of the River Trent at Great Haywood, Moreton Brook and a tributary of Kingston Brook at Hopton.

15.2.6 Groundwater levels have been inferred from the available Environment Agency groundwater level monitoring boreholes, historic borehole logs and topographic data, as well as from spring and watercourse locations.

15.2.7 The assessment is based on existing available water quality information provided by the Environment Agency.

15.2.8 Impacts on biological receptors such as aquatic fauna and flora, which are referred to in the WFD compliance assessment, Volume 5: Appendix WR-001-000, are assessed in Section 8, Ecology and biodiversity.

[227] Department for Communities and Local Government, National Planning Policy Framework, 2015.
[228] Volume 5: Appendix CT-001-001, Environmental Impact Assessment Scope and Methodology Report.
[229] Volume 5: Appendix CT-001-002, Environmental Impact Assessment Scope and Methodology Report Addendum.

15.3 Environmental baseline

Existing baseline - Water resources and WFD

Surface water

15.3.1 All water bodies in the study area fall within the Staffordshire Trent Valley Catchment of the Humber river basin district (RBD).

15.3.2 The river basin management plan[230] identifies the chemical[231] and ecological[232] condition of surface waterbodies, and the quantitative[233] and chemical[234] status of groundwater bodies within this RBD.

15.3.3 The statutory objective of the WFD is to prevent deterioration of all water bodies at good or high status and to prevent water bodies at less than good status from deteriorating further.

15.3.4 Specialist field surveys have been undertaken, where access has been available. This has included the majority of surface water bodies within the study area. Receptor values have been adjusted to reflect the outputs from these surveys, in close consultation with the Environment Agency. In the absence of field surveys, surface water bodies, other than minor ponds and ditches, have been identified within this assessment as being of either high or very high value on a precautionary basis.

15.3.5 Summary information relating to the surface water bodies crossed by the Proposed Scheme within this study area, including their location, current overall WFD status and future overall status objectives, is provided in Table 37. Table 37 also identifies the receptor values attributed to each individual watercourse based on the methodologies set out in the SMR, the SMR Addendum, and as applied in the WFD compliance assessment (Volume 5: Appendix WR-001-000).

Table 37: Key surface water bodies and their WFD status.

Water body name and identification number[235]	Current WFD status[236]	WFD status objective	Watercourse classification	Crossing location (National Grid Reference) [237]	Receptor value
Moreton Brook from Source to River Trent GB104028047380	Moderate	Good by 2021	Ordinary watercourse	Tributary of the the Moreton Brook at NGR 402756, 322766to NGR 403423, 322498	Low
Trent from Tittensor to River Sow GB10408053272	Bad	Poor by 2027	Main river	River Trent at Great Haywood (from NGR 399805, 323614 to NGR 399107, 323783)	Very high

[230] Environment Agency (2015), Water for life and livelihoods Part 1: Humber river basin district: River basin management plan.
[231] The chemical status of surface waters reflects concentrations of priority and hazardous substances present.
[232] The ecological status of surface waters is determined based on the following elements:
- Biological elements – communities of plants and animals (for example, fish and rooted plants), assessed in the ecology and biodiversity section;
- Physico-chemical elements – reflects concentrations of pollutants such as metal or organic compounds, such as copper or zinc;
- Hydromorphological elements – reflects water flow, sediment composition and movement, continuity (in rivers) and the structure of physical habitats.

[233] The quantitative status of groundwater 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.
[234] 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.
[235] The Environment Agency has attributed each surface water and groundwater body a unique water body identification (ID) number.
[236] See Volume 5: Appendix WR-001-000 (WFD Compliance Assessment Report) for definitions of WFD status.
[237] This location is where the Proposed Scheme will cross the watercourse.

Water body name and identification number[235]	Current WFD status[236]	WFD status objective	Watercourse classification	Crossing location (National Grid Reference) [237]	Receptor value
	Main river tributaries:				
	Bad	Poor by 2027	Ordinary watercourse	Tolldish (NGR 400460, 323450)	Moderate
	Bad	Poor by 2027	Minor ditch	Lionlodge (NGR 398569, 323914)	Low
	Bad	Poor by 2027	Minor ditch	Marston Bridleway (NGR 392685, 327505)	Low
	Bad	Poor by 2027	Minor ditch	Yarlet Wood (NGR 391480, 328753)	Low
Trent and Mersey Canal, summit to Alrewas GB70410142	Good	Good by 2015	Main river	Trent and Mersey Canal, Great Haywood (from NGR 399805, 323614 to NGR 399107, 323783)	Very high
Sow-Doxey Brook to River Penk GB104028046790	Poor	Moderate by 2015	Ordinary watercourse	Hopton (NGR 394550, 325759)	Moderate
	Poor	Moderate by 2015	Ordinary watercourse	Mount Edge (NGR 393783, 326057)	Low
	Poor	Moderate by 2015	Ordinary watercourse	Berryhill (South) (NGR 391430, 328783)	Low

Abstractions and permitted discharges (surface water)

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

15.3.7 Records of private unlicensed surface 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 are no registered private unlicensed surface water abstractions within the study area. As there is no obligation to register private water supplies, unregistered private groundwater supplies may be present. Private water supplies have been assessed as high value receptors unless details obtained from the owner indicate otherwise.

15.3.8 There are 18 consented discharges to surface waters within the study area, three of which are within the area of land required for the Proposed Scheme. These have been assessed as being receptors of low value.

Groundwater

15.3.9 The location of abstractions, geological formations and indicative groundwater levels, where available, are shown in Map Series WR-02 in Volume 5: Water resources and flood risk Map Book.

15.3.10 The geology of the study area is described in Section 10, Land quality, and the superficial and bedrock hydrogeology is summarised in Table 38. Unless stated otherwise, the geological groups listed will all be crossed by the Proposed Scheme. Table 38 also identifies the receptor values attributed to each groundwater receptor

based on the methodologies set out in the SMR, the SMR Addendum, and as applied in the WFD compliance assessment (Volume 5: Appendix WR-001-000).

Table 38 Summary of geology and hydrogeology in the study area

Geology[238]	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status	WFD status objective	Receptor value
Superficial deposits						
Peat	Approximately 1km south-west of Hopton and elongated patches to the south of the Proposed Scheme	Organic rich clay or humic deposits	Unproductive	Not assessed by Environment Agency	Not assessed by Environment Agency	Low
Alluvium	Along the River Trent and tributaries	Clay, silt, sand and gravel	Secondary A	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
River Terrace Deposits	Along the River Trent valley	Sand and gravel	Secondary A	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
Glaciofluvial Sheet Deposits	Around Tixall, following the unnamed watercourse; in the vicinity of Stafford and Hopton; and along the Trent Valley near Yarlet and Salt	Sand and gravel	Secondary A	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
Glacial Till	Small patches along the route of the Proposed Scheme	Sandy silty clay	Secondary (Undifferentiated)	Not assessed by Environment Agency	Not assessed by Environment Agency	Low
Bedrock						
Mercia Mudstone Group – Mudstone	Along the majority of the route of the Proposed Scheme	Siltstone with some halite-bearing units, and presence of sandstone	Secondary B	Staffordshire Trent Valley - Mercia Mudstone East and Coal Measures (GB40402, G300300)- Good Staffordshire Trent Valley –	Good by 2015	Moderate

[238] In recent years the British Geological Survey has revised the nomenclature used to describe the geological materials present in Great Britain, with the publication of a series of lithostratigraphic framework reports. Some of these reports cover an entire geological period e.g. The Carboniferous and others cover a single group e.g. the Triassic Mercia Mudstone. The nomenclature used in these reports supersede the nomenclature introduced in the 1980s, when the Group/ Formation / Member classification was adopted by the British Geological Survey, replacing the earlier classification adopted by the pioneer geological surveyors in the 19th century. While some traditional names have been retained by this process, many new names have also been generated, and many geological maps have not yet been updated. Some stratigraphic units have been renamed twice in the last 35 years. To reflect this, the previous name used for geological units (if different) is shown in brackets.

Geology[238]	Distribution	Formation description	Aquifer classification	WFD body (ID) and current overall status	WFD status objective	Receptor value
				Mercia Mudstone West (GB40402, G300400) – Good		
Mercia Mudstone Group – Stafford Halite Member	To the north of the route of the Proposed Scheme from Yarlet to Sandon at the northern end of the Colwich to Yarlet area	Beds of halite mixed with mudstone	Secondary B	Staffordshire Trent Valley - Mercia Mudstone West (GB40402, G300400) - Good	Good by 2015	Moderate
Sherwood Sandstone Group - Helsby Sandstone Formation (Bromsgrove Sandstone formation)	Extends to the north and south of the route of the Proposed Scheme, approximately between Hopton and Lambert's Coppice	Pebbly or conglomeratic at the bases of beds, interbedded with siltstones and mudstones.	Principal	Staffordshire Trent Valley - PT Sandstone Staffordshire (GB40401, G300500) – Poor	Poor by 2015	High
Sherwood Sandstone Group - Helsby Sandstone Formation (Bromsgrove Sandstone Formation)	To the north of the route of the Proposed Scheme around Hopton Heath and to the south of the route at Hanyards	Mudstone	Secondary B	Staffordshire Trent Valley - PT Sandstone Staffordshire (GB40401, G300500)- Poor	Poor by 2015	Moderate
Sherwood Sandstone Group -Chester Formation (Kidderminster Formation)	To the south of Hopton and around Salt	Pebble conglomerate in a sandy matrix	Principal	Staffordshire Trent Valley - PT Sandstone Staffordshire (GB40401, G300500) – Poor	Poor by 2015	High

Superficial deposits aquifers

15.3.11 The basis of the receptor values attributed to the superficial deposit aquifers present within the study area, as shown in Table 38, is outlined briefly as follows:

- Alluvium, River Terrace and Glaciofluvial Sheet Deposits may be capable of supporting water supplies at a local rather than regional scale and may also form a source of baseflow to rivers. They have therefore been classified as moderate value receptors;
- Glacial Till deposits may supply baseflow to watercourses or store and yield limited amounts of groundwater and so have been classified as low value receptors; and
- deposits of peat are classified as Unproductive in this area and, therefore, are low value receptors in terms of water resources.

Bedrock aquifers

15.3.12 The basis of the receptor values attributed to the bedrock aquifers present within the study area, as shown in Table 38, is briefly as follows:

- the Sherwood Sandstone Group (locally comprising sandstones of the Helsby Sandstone Formation and the Chester Formations) has been classified as a Principal aquifer by the Environment Agency. This aquifer can also provide an important component of baseflow to rivers. It has therefore been assessed a high value receptor; and
- the Mercia Mudstone Group has traditionally been regarded as predominantly impermeable, or at best a poor aquifer. Limited quantities of groundwater suitable for domestic or agricultural use are however occasionally obtainable within this rock formation and it has therefore been classifed as a moderate value receptor.

WFD status of groundwater bodies

15.3.13 A summary of locations, current overall WFD status, and future overall status objectives associated with the designated bedrock groundwater bodies within the study area is provided in Table 38. The value attributed to each of these receptors is also indicated.

15.3.14 The superficial deposits in the study area are not formally designated as WFD groundwater bodies but may be hydraulically connected to the WFD bedrock aquifers.

Abstraction and permitted discharges (groundwater)

15.3.15 There is one public water supply abstraction located approximately 2.5km south of the route of the Proposed Scheme. The groundwater source protection zone (SPZ) 2 associated with this supply extends to approximately 1km from the route of the Proposed Scheme, south of Great Haywood.

15.3.16 There are three private groundwater abstractions licences located in the study area. These are located at Moreton Grange, Ingestre Park Golf Club and the Staffordshire County Showground. The nature of the Ingestre Park Golf Club abastraction has yet to be confirmed due to access constraints. Therefore, in the absence of a site inspection it has been assumed to be a high value receptor. The abstractions at Moreton Grange and the Staffordshire County Showground are known to comprise potable water supply abstractions and are therefore assessed has high value receptors.

15.3.17 Information obtained from the local authorities indicates that there are four unlicensed private water supplies which have been assessed as high value receptors unless details obtained from the owner indicate otherwise.

15.3.18 There are 10 consented discharges to groundwater within the study area. These discharges have been assessed as low value receptors.

Surface water/groundwater interactions

15.3.19 Desk-based assessment using Ordnance Survey maps identified 30 features within the study area that had potential to be springs. Access was possible to inspect six of these features, one of which was confirmed to be a spring of high value that potentially

feeds Lount Farm LWS. The other five features were verified as minor land drainage features of low value. An additional spring was identified during the site survey, located south-west of Moreton House, within the area required for construction of the Proposed Scheme. The remaining 23 potential spring features are assumed to be high value receptors, pending site inspection. Three of these are within the area required for the Proposed Scheme at Lower Bridge Farm, Marston Farm and Marston Cottages.

15.3.20 There are 40 ponds within the land required for the Proposed Scheme. These provide a range of aquatic habitats. The nature and relative value of these features, the magnitude of the impacts that the Proposed Scheme will have on them, and the mitigation proposed, are outlined in Chapter 8, Ecology and biodiversity.

Groundwater dependent habitats

15.3.21 The following features within the study area are potentially groundwater dependent:

- Pasturefields Special Area of Conservation (SAC) and Site of Special Scientific Interest (SSSI) is an inland saltmarsh located approximately 900m north of the route of the Proposed Scheme at its closest point. This is a very high value receptor;
- an area of marshland located to the north of the Proposed Scheme, thought to be part of Lount Farm LWS. This LWS also extends into the Fradley to Colton community area (CA1), but the area of marshland, which has been assessed as a moderate value receptor, lies within the Colwich to Yarlet study area; and
- Lionlodge Covert LWS is located to the north-west of Great Haywood and contains an inland salt meadow supported from brine springs. These springs have been assessed as high value receptors.

15.3.22 Further details of these sites are outlined in Section 8, Ecology and biodiversity.

Existing baseline - flood risk and land drainage

15.3.23 The Environment Agency's Flood map for planning (rivers and sea)[239] has been used to scope the baseline flood risk for flooding from main rivers and ordinary watercourses. These plans define Flood Zone 2 (land assessed as having between a 1 in 100 (1%) and 1 in 1,000 (0.1%) annual probability of river flooding) and Flood Zone 3 (land assessed as having a 1 in 100 (1%) or greater annual probability of river flooding).

15.3.24 The updated Flood map for surface water[240] has been used to scope surface water flood risks. Infrastructure failure flood risks have been scoped using the Environment Agency risks of flooding from reservoirs national dataset[241]. The British Geological Survey national dataset, Areas susceptible to groundwater flooding[242], has been used to assess the future risk of groundwater flooding.

[239] http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=floodmap&layerGroups=default&lang=_e&ep=map&scale=8&x=435500&y=335500
[240] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=402498&northing=282043&address=100070518535
[241] https://flood-warning-information.service.gov.uk/long-term-flood-risk/map?easting=402498&northing=282043&address=100070518535
[242] http://www.bgs.ac.uk/products/hydrogeology/groundwaterFlooding.html

15.3.25 The following reports were used to help scope the baseline flood risk within the study area:

- Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011)[243];
- South Staffordshire, Cannock Chase, Lichfield and Stafford Strategic Flood Risk Assessment (SFRA) (2014)[244]; and
- Shropshire and Staffordshire Local Flood Risk Management Strategy (2015)[245].

15.3.26 River and surface water flood zones are shown in Map Series WR-01 in Volume 5: Water resources and flood risk assessment Map Book.

River flooding

15.3.27 The study area includes substantial areas of floodplain (Flood Zone 2 and 3) associated with the River Trent at Great Haywood and tributary watercourses.Table 39 shows the watercourses and the receptors that would potentially be affected by any changes in flood frequency and magnitude. The value of these receptors, based on Table 52 of the SMR, is also indicated.

Table 39: River flood risk sources and receptors

Source	Location (NGR)	Receptor potentially affected	Receptor value
Tributary of the Moreton Brook	NGR 396805, 32514 to NGR 395107, 325783	Moreton Grange	High
		Bishton Lane	Moderate
River Trent	Great Haywood NGR 399805, 323614 to NGR 399107, 323783	Hoo Mill	High
		Hoo Mill Lane	Moderate
		Hoo Mill Cottages	High
		Trent and Mersey Canal	Low
		Mill Lane	Moderate
		Six properties located along Mill Lane	High
		The Mill	High
		Great Haywood Marina	Low
		Staffordshire and Worcestershire Canal	Low
		Shugborough Hall	Very high
Ordinary watercourse at Tolldish culvert	Tolldish NGR 400460, 323450	Properties along Tolldish Lane	High
		A51 Lichfield Road	Moderate

[243] Staffordshire Preliminary Flood Risk Assessment (PFRA) (2011) Staffordshire County Council.
[244] South Staffordshire, Cannock Chase, Lichfield and Stafford Strategic Flood Risk Assessment (SFRA) (2014) Capita.
[245] Shropshire and Staffordshire Local Flood Risk Management Strategy (LFRMS) (2015) Staffordshire County Council.

Source	Location (NGR)	Receptor potentially affected	Receptor value
Ordinary watercourse at Lionlodge culvert	Lionlodge NGR 398569, 323914	Agricultural land	Moderate
Ordinary Watercourse at Hopton culvert	Hopton NGR 394550, 325759	Agricultural land	Moderate
Watercourse at Mount Edge diversion	Mount Edge NGR 393783, 326057	Agricultural land	Moderate
Watercourse at Berryhill (south) culvert	Berryhill (South) NGR 391430, 328783	Agricultural land	Moderate

Surface water flooding

15.3.28 There are numerous areas that are susceptible to surface water flooding within the study area. These are identified on maps WR-01-102b to 104a in the Volume 5: Water resources and flood risk Map Book. The key sources and receptors with potential to be affected are shown in Table 40. The value of these receptors, based on Table 52 of the SMR, is also indicated.

Table 40: Surface water flood risk sources and receptors

Source	Location (NGR)	Receptor potentially affected	Receptor value
Surface water flow path associated with a tributary of Moreton Brook	Moreton Grange NGR 402759, 322757	Moreton Grange	High
Surface water flow path draining Tithebarn Covert	Tithebarn covert NGR 400960, 323331	Agricultural land	Moderate
Surface water flow paths draining area near Tixall	Upper Hanyards Farm NGR 396480, 324667	Agricultural land	Moderate
Surface water flow path at Trent Walk	Trent Walk NGR 395804, 325012	Agricultural land	Moderate
Surface water flow path at A518 Weston Road	Berryhill (north) NGR 395413, 325231	Agricultural land	Moderate
Surface water flow path along Sandon Road	Sandon Road NGR 393767, 326410	Sandon Road	Moderate
Surface water flow path in the vicinity of Marston Lane	Marston Bridleway NGR 392685, 327505	Agricultural land	Moderate
Surface water flow paths associated with watercourse at Yarlet	Yarlet Wood NGR 391480, 328753	Agricultural land	Moderate
Surface water flow path at Yarlet Bank	Yarlet Bank NGR 391006, 329280	Yarlet Bank Farm	High
Surface water flow path at Peasley Bank	Peasley Bank NGR 390637, 329733	Agricultural land	Moderate

Artificial water bodies

15.3.29 Flooding from artificial water bodies may occur due to the failure of an impounding structure, such as a dam or canal embankment. The Flood risk assessment (Volume 5: Appendix WR-003-002) considers the risks associated with artificial water bodies

within the study area, including Tixall Park Pool, Hopton Pools, the Trent and Mersey Canal and the Staffordshire and Worcestershire Canal. Hopton Pools are the onlyartificial water bodies that have flood risk implications for the Proposed Scheme.

15.3.30 Hopton Pools comprise two fish ponds at Hopton, approximately 800m upstream of the route of the Proposed Scheme. Water within both ponds is impounded above surrounding ground levels by embankments. In the event of a failure of these embankments, downstream receptors, including the Proposed Scheme would be flooded.

Groundwater flooding

15.3.31 The formal source of public information regarding historical incidents of groundwater flooding in the Colwich to Yarlet area is the South Staffordshire Council SFRA[246]. The SFRA states that there is no history of groundwater flooding within the Stafford Borough.

15.3.32 The areas susceptible to groundwater flooding map indicates a potential for groundwater flooding to occur along the River Trent Valley. There is also potential for groundwater flooding to occur in other areas where Alluvium, River Terrace Deposits and Glaciofluvial Sheet Deposits are present.

Land drainage

15.3.33 Existing topography, soils and land drainage systems within the study area are described in Section 4, Agriculture, forestry and soils. The rivers and watercourses within the area are connected to an extensive network of existing open drains. Subsurface drainage systems are also likely to be present in fields used for agriculture. The land drainage function of these systems, which is important for crop productivity, is potentially sensitive to increases in water levels within the receiving watercourses.

Future baseline

Construction (2020)

15.3.34 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2020.

15.3.35 No committed developments have been identified in this area that will materially alter the baseline conditions in 2020.

Operation (2027)

15.3.36 Volume 5: Appendix CT-004-000 provides details of the developments that are assumed to have been implemented by 2027.

15.3.37 No committed developments have been identified in this area that will materially alter the baseline conditions in 2027.

[246] South Staffordshire, Cannock Chase, Lichfield and Stafford Strategic Flood Risk Assessment (SFRA) (2014) Capita.

Climate change

15.3.38 Detailed analysis of the potential impacts of climate change on the Proposed Scheme has been undertaken and is reported in Volume 3, Route-wide effects (Section 4). In general, the design of the Proposed Scheme has adopted a precautionary approach to potential future increase in peak river flows and rainfall intensities, using the guidance issued by the Environment Agency in February 2016[247].

15.3.39 Although no definitive guidance is available, climate change may also affect future surface water and groundwater resources. However any such changes are unlikely to change the significance of effects identified in this assessment.

15.4 Effects arising during construction

Avoidance and mitigation measures

15.4.1 The principal strategy adopted to limit the temporary and permanent effects of the Proposed Scheme is through avoidance of sensitive receptors wherever reasonably practicable. Where receptors could not be avoided, mitigation measures have been incorporated where appropriate and reasonably practicable, to limit the potential effects. Section 16 of the draft Code of Construction Practice[248] (CoCP) includes a range of mitigation measures that aim to reduce construction impacts. The avoidance and mitigation measures that are of particular relevance to water resources and flood risk during construction are described in the following sections of this report.

Water resources and WFD

15.4.2 The avoidance of sensitive receptors has reduced the risks associated with the Proposed Scheme not complying with the requirements of the WFD. Examples of this avoidance strategy include:

- avoidance of channels and floodplain areas – the route of the Proposed Scheme will avoid passing along river or stream valleys, such as that of the River Trent, and its associated floodplains. Instead it will pass over the larger watercourses on viaducts spanning the floodplain, with piers set back from the channel;
- avoidance, where reasonably practicable, of groundwater dependent terrestrial ecosystems, such as Pasturefields SAC and SSSI, and natural springs that can play a key role in the hydrology and hydrogeology of such ecosystems; and
- avoidance, where reasonably practicable, of major public water supplies and smaller licensed and unlicensed abstractions of surface water and groundwater.

15.4.3 The presence of any unregistered private water supplies, their function and the means of protecting or if necessary replacing them will be discussed with any landowners potentially affected by the Proposed Scheme.

[247] Environment Agency (2016) Adapting to Climate Change. Advice for Flood and Coastal Erosion Risk Management Authorities.
[248] Volume 5: Appendix CT-003-000, Draft Code of Construction Practice.

15.4.4 The temporary works shown on Map Series CT-05 in Volume 2: CA2 Map Book have been informed by a detailed consideration of the water resources constraints and have sought to avoid sensitive features wherever reasonably practicable.

15.4.5 Where watercourse diversions and/or realignments are proposed, the aim will be to design these with equivalent hydraulic capacity to the existing channels. The Proposed Scheme will also aim to ensure that field subsurface drainage systems can be adapted to discharge into the new channel. Where such watercourses are natural channels, the design will aim to incorporate appropriate features to retain and, where reasonably practicable, enhance their hydromorphological condition[249].

15.4.6 For watercourses that are not in their natural condition, the design aim will be to incorporate measures, where reasonably practicable, to improve their hydromorphological condition, provided this is compatible with the watercourses' flood risk and land drainage functions.

15.4.7 The draft CoCP includes requirements to protect water bodies and their associated water resources from the potential impacts of pollution from construction site runoff, including where appropriate:

- provision of maps showing sensitive areas and buffer zones where no pollutants are to be stored or used; and
- preparation of method statements for silt management, site drainage at compounds and satellite compounds, for the storage and control of oils and chemicals and the prevention of accidental spillages, in consultation with the Environment Agency, and if appropriate, the LLFA and other relevant authorities, as part of the approvals process. These method statements will cover, where applicable:
  - the avoidance of discharges of site runoff to ditches, watercourses, drains, sewers or soakaways without the prior approval of the appropriate authority;
  - measures to prevent silt-laden runoff and other pollutants entering the water environment; and
  - restrictions or controls on excavation within watercourses to limit effects on water quality, sedimentation, fisheries and aquatic ecology.

15.4.8 Method statements will be required for all watercourse crossings and channel realignments required by site haul routes. The method statements will describe how potential changes to flood risk, water quality and channel morphology will be safeguarded during the establishment, use and decommissioning of all site haul routes.

15.4.9 Permanent culverts proposed on the smaller watercourse crossings within this study area include Tolldish culvert, Lionlodge culvert and Yarlet Wood drop inlet culvert, all on minor unnamed tributaries of the River Trent, and the Berryhill (South) culvert, Hopton culvert and the culvert under Mount Edge road diversion on minor tributaries

[249] "Hydromorphological condition" reflects the extent to which water flow, sediment composition and movement, continuity (in rivers) and the structure of physical habitats departs from that expected of a natural river or stream system.

of Kingston Brook. The detailed design of these culverts will be developed in general accordance with the Construction Industry Research and Information Association (CIRIA) and Environment Agency guidance and in consultation with the Environment Agency specialists. The design has sought to mitigate the impact on the hydromorphology of the affected watercourses, as follows:

- drop inlet culverts have been avoided wherever reasonably practicable and are proposed on minor headwater channels or ditches only;
- culvert lengths have been reduced as far as is reasonably practicable; and
- invert levels will be set below the firm bed of the watercourse to allow a natural substrate to develop along the bed of the culvert.

15.4.10 The wider issues associated with these culverts, and how their detailed design will aim to ensure no deterioration in the status of any of the relevant water body's WFD quality elements, are considered within the WFD compliance assessment (WR-001-000). The mitigation specifically proposed for the ecological effects of these culverts is considered in Section 8, Ecology and biodiversity.

15.4.11 Existing groundwater abstraction boreholes or monitoring points will be protected from physical damage, insofar as reasonably practicable, including appropriate decommissioning of abandoned boreholes in order to prevent pollution pathways. If boreholes are to be decommissioned and replaced with alternatives, the contractors will follow the latest good practice. This will also be applicable to springs potentially affected by construction works, although additional measures may be required to mitigate temporary construction impacts on springs that are to be relocated.

15.4.12 Measures will be introduced, as required, to mitigate the temporary and permanent effects on groundwater flows and water quality during excavation and construction of foundations and cuttings as far as is reasonably practicable. The types of measure likely to be adopted could include:

- installation of cut-off[250] 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
- incorporation of passive bypasses within the design, which could comprise a 'blanket' of permeable material, such as gravel, placed around temporary structures allowing groundwater to bypass the below-ground works, without a rise in groundwater levels on the upstream side.

15.4.13 The exact requirements will be refined and method of mitigation will be designed following ground investigation at cutting locations.

[250] Impermeable barrier preventing water flow.

Flood risk and land drainage

15.4.14 The design of the Proposed Scheme will aim to mitigate permanent impacts on flood risk and land drainage as follows:

- the floodplain avoidance strategy will ensure that impacts on flood flows within rivers and streams, and their floodplains, will be limited to those associated with the intermediate pier structures on the viaduct at Great Haywood. The Proposed Scheme includes replacement floodplain storage areas to replace losses associated with the piers;
- the temporary works shown on Map Series CT-05 in the Volume 2: CA2 Map Book have been informed by a detailed consideration of the flood risk constraints and have sought to avoid flood zones wherever reasonably practicable;
- provision has been made to pass surface water runoff and land drainage flows beneath sections of raised embankment that will cross surface water flow paths, where reasonably practicable. This will be achieved using perimeter drainage and culverts, with their inverts set below the likely level of any upstream field subsurface drainage systems;
- in locations where the route of the Proposed Scheme will cross watercourses, the design aim is for structures to accommodate flood flows up to and including the 1 in 100 (1%) annual probability storm with an allowance for climate change based on latest guidance issued by the Environment Agency[251];
- 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 aims to ensure that there will be 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 and highway drainage have been sized on a precautionary basis, pending more detailed information about the permeability and runoff characteristics of existing and proposed ground surfaces;
- where the Proposed Scheme will pass in cutting, drainage will be provided with the aim of preventing flow into the cutting and diverting this water into its natural catchment. Where reasonably practicable, runoff from the cuttings will also be drained to the catchments to which this water would naturally drain, avoiding transfer of water from one water body to another, which could increase flood risk or impact on land drainage systems; and
- measures will be introduced to reduce any potentially significant effects on groundwater flood risk as far as is reasonably practicable, including the

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

incorporation of passive hydraulic bypasses at cuttings and other below ground structures. These could for example comprise a 'blanket' of permeable material such as gravel.

15.4.15 The nominated undertaker will, insofar as reasonably practicable, ensure that flood risk is managed throughout the construction period and will consider flooding issues when planning sites and storing materials. If necessary, temporary provision will be made to reduce the potential for impacts on existing land drainage systems during construction. Some of the specific measures referred to in Section 16 of the draft CoCP, include:

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

15.4.16 In accordance with Section 16 of the CoCP, monitoring will also be undertaken in consultation with the Environment Agency and where applicable, the LLFA, to ensure that temporary structures are installed, maintained and removed in accordance with the relevant environmental approvals and that impacts on existing land drainage systems are managed appropriately.

Assessment of impacts and effects

15.4.17 This section describes the significant effects following the implementation of the avoidance and mitigation measures. The majority of the potential temporary impacts on the water environment during construction will be avoided or mitigated by the working methods outlined in the CoCP. The mitigation embedded into the design has focused on reducing permanent impacts resulting from the presence of the Proposed Scheme to as low a level as is reasonably practicable.

Temporary effects – Water resources and WFD

Surface water

15.4.18 Potential temporary impacts on surface water quality, due to site runoff and increased pollution risk, are a key concern during construction and have the potential to affect abstractions and the water environment more generally. However, the practices

outlined in the draft CoCP are considered adequate to mitigate any impacts, such that there are unlikely to be any significant effects.

Groundwater

Aquifers

15.4.19 The proposed cuttings in the study area will intersect the Sherwood Sandstone Group Principal aquifer, the Mercia Mudstone Group Secondary B aquifer, the Stafford Halite Member Secondary B aquifer and the Glacial Till Secondary Undifferentiated aquifer. Whilst there are likely to be minor localised impacts, the implementation of the measures outlined in the draft CoCP will mean that any impacts on the overall status of these aquifers will not be significant. Where the cuttings could affect local receptors that rely on the resource, such as springs and abstractions, this is reported in the sections below.

Abstractions

15.4.20 The abstractions at Moreton Grange, near to Moreton cutting, and the abstraction at Ingestre Park Golf Club, near to Brancote South cutting, are are at risk of temporary impacts during construction due to their proximity to the area required for construction of the Proposed Scheme. The private unlicensed abstractions at Bishton Lane Farm, Bishton Farm and near Bishton Hall Farm also have potential to be temporarily impacted by the widening of Bishton Lane. These water supplies will be protected or, if necessary, replaced prior to construction of the Proposed Scheme commencing, which will result in there being no significant temporary effects.

Groundwater–surface water interactions

15.4.21 There is a spring feature south-west of Moreton House which feeds into a man-made pond. This spring feature will be intercepted by the land drainage systems to be constructed as part of the Proposed Scheme, which has potential to affect the pond. However, the pond will be infilled as part of the Proposed Scheme and the impact of this is considered in Section 8, Ecology and biodiversity. The spring feature that feeds this lake will be intercepted by the land drainage systems to be constructed as part of the Proposed Scheme. No adverse effects related to the loss of this spring feature are anticipated.

15.4.22 Pasturefields SSSI and SAC is located approximately 900m north of the route of the Proposed Scheme, within the floodplain of the River Trent. Drainage pathways show that the hydraulic gradient in the vicinity of the Proposed Scheme is away from, rather than towards, the Pasturfields site. The saline groundwater source feeding Pasturefields SSSI and SAC is upwelling from depth within the Mercia Mudstone Formation. The Proposed Scheme design elements in this area comprise above-ground embankment and shallow piles associated with the River Trent viaduct. These would not affect the groundwater sources feeding the Pasturefields site. Consequently, the assessment has identified no potential for significant effects. Potential impacts on Pasturefields SAC and SSSI are discussed further in Section 8, Ecology and biodiversity.

Temporary effects - Flood risk and land drainage

15.4.23 Construction of the Great Haywood viaduct over the River Trent and its associated floodplain will require temporary working within flood zones, including the establishment of site haul routes over the River Trent and the Trent and Mersey Canal at Great Haywood. Construction sequencing and temporary works design will be carefully considered and assessed in terms of potential impacts on flood risk. Method statements detailing how these works will be undertaken will be produced by the nominated undertaker in close consultation with the Environment Agency and Canal & River Trust. It is not anticipated that these temporary activities will result in significant effects related to flood risk and land drainage.

15.4.24 Hydraulic modelling has not identified any impacts on the depth and frequency of flooding associated with the construction of the Great Haywood viaduct at Pasturefields SSSI and SAC. This means that salinity levels at this site will not be affected by the construction of the Proposed Scheme as a result of increases in flood frequency. The modelling undertaken has identified that the Proposed Scheme will not affect flood risk at Shugborough Hall.

Permanent effects – Water resources and WFD

15.4.25 Permanent effects are those initially caused by activity to construct the Proposed Scheme but which will also remain after the Proposed Scheme has been constructed and is present in the area.

Surface water

15.4.26 Construction of the Great Haywood viaduct will not prevent the River Trent from achieving good ecological status, in line with the WFD objectives in the RBMP. The piers will be set back from the channel and the viaduct will be of sufficient height for any potentially detrimental shading impacts to be negligible.

15.4.27 Construction works will require diversion of a minor tributary watercourse near Tolldish, such that flows from the watercourse will enter the channel approximately 1.6km further downstream from the existing location. Site surveys have indicated that the upstream section of this watercourse is a minor drainage ditch of low value. Therefore, these changes will have a negligible impact on flows in this watercourse and will not give rise to significant effects.

Groundwater

Aquifers

15.4.28 Implementation of the avoidance and mitigation measures will ensure that there are no permanent significant effects related to the impact of the proposed cuttings on water levels and quality in the aquifers intercepted by the Proposed Scheme. Where the impacts of the cuttings on the aquifers could affect additional local receptors that rely on the groundwater resource, for example springs and abstractions, the impacts on these have been assessed below.

Abstractions

15.4.29 On a precautionary basis it has been identified that there is the potential for the Proposed Scheme to have a permanent adverse effect on the existing water supplies at Moreton Grange, Ingestre Park Golf Club, Bishton Lane Farm, Bishton Farm and near Bishton Hall Farm. This will be kept under review during detailed design of the Proposed Scheme and, if necessary, the relevant temporary mitigation measures will be designed so as to provide permanent mitigation for these adverse effects.

15.4.30 The private unlicensed abstraction at Upper Hanyards Farm will be decommissioned as a result of the construction of the Brancote South cutting and the demolition of Upper Hanyards Farm. This abstraction also supplies water to Lower Hanyards Farm. HS2 Ltd will continue to engage with the affected landowner and a permanent alternative water supply will be provided, such that there will be no significant effect on this abstraction.

Groundwater-surface water interactions

15.4.31 There will be permanent loss of some saline springs reportedly feeding an area of inland saltmarsh meadow at the southwest end of Lionlodge Covert. It is proposed to create a similar groundwater dependant saltmarsh habitat nearby. Whilst the springs have been surveyed, surveys of the saltmarsh habitat have not been possible due to access constraints. Until the proposals to mitigate the impacts on this saltmarsh have been developed, there remains a potential major adverse effect related to this system, which is significant.

15.4.32 There may be a permanent reduction in the groundwater catchment area to the potential spring at Lower Bridge Farm due to the Hopton North cutting. This has been assessed as a high value receptor on a precautionary basis and so its loss has potential to result in a moderate adverse effect, which is significant.

Permanent effects - Flood risk and land drainage

15.4.33 The design will ensure that sensitive flood receptors such as Shugborough Hall and Pasturefields SAC and SSSI will not be affected by the Proposed Scheme.

15.4.34 Breach of the existing dams impounding Hopton Pools, which are on a tributary of the Kingston Brook at Hopton, would result in the escape of a significant quantity of water potentially affecting the Proposed Scheme and other properties downstream of these ponds. Modelling of this potential scenario has been undertaken and is reported within the flood risk assessment (Volume 5: Appendix WR-003-002). The design of this tributary crossing incorporates three parallel culverts with the capacity to accommodate the flows resulting from such a breach, without increasing flood risk elsewhere. The effects of the Proposed Scheme related to flood risk at this location will therefore be negligible, which is not significant.

Other mitigation measures

15.4.35 Additional mitigation measures have been developed to further reduce the temporary and permanent impacts of construction stage activities, where there is potential for the Proposed Scheme to result in significant effects.

15.4.36 An inspection will be undertaken of the potential spring feature at Lower Bridge Farm. If this proves to be a spring, further investigations will be undertaken of groundwater flows in this area to establish whether they are likely to be adversely affected by construction of the proposed Hopton North cutting, following which mitigation measures will be developed, if required.

15.4.37 Further hydrogeological surveys will be undertaken of the area around the existing saltmarsh at the south-western end of Lionlodge Covert to help determine the feasibility of creating/restoring nearby groundwater dependant saltmarsh habitat. Without such mitigation, the loss of the saline springs, which are high value receptors that feed the saltmarsh, would potentially result in a major adverse effect, which is significant.

Summary of likely residual significant effects

15.4.38 In the absence of the other mitigation measures set out above, the Proposed Scheme has the potential to result in residual significant effects as follows:

- permanent decrease in groundwater catchment to the spring at Lower Bridge Farm caused by the Hopton North cutting; and
- permanent loss of the saline springs feeding the saltmarsh at the south-western end of Lionlodge Covert.

15.4.39 It is currently anticipated that it should be possible to develop the means of mitigating these impacts, to ensure that there are no residual significant effects arising from construction of the Proposed Scheme.

Cumulative effects

15.4.40 No significant cumulative temporary or permanent effects during construction with regard to water resources or flood risk are anticipated.

15.5 Effects arising from operation

Avoidance and mitigation measures

15.5.1 The principal issue of concern during operation of the Proposed Scheme is the potential for accidental spillages to occur that could result in the release of contaminants into the water environment. This issue has been assessed on a route-wide basis in Volume 3: Route-wide effects (Section 16), where the mitigation measures associated with this risk are described. A draft operation and maintenance plan for water resources and flood risk is provided in Volume 5: Appendix WR-002-000.

15.5.2 The design takes into account the policies in the NPPF and will aim to ensure that the Proposed Scheme is safe from flooding without increasing flood risk elsewhere, as outlined in the Appendix WR-003-002, Flood risk assessment. Evidence of application of the Sequential Test and Exception Tests in the NPPF is provided on a route-wide basis in Volume 3: Route-wide effects.

15.5.3 Sustainable drainage systems will be used where reasonably practicable. These will help to remove any suspended material within runoff from the Proposed Scheme through filtration, vegetative adsorption or settlement. The drainage systems

proposed will aim to ensure that the quantity and quality of water draining from the Proposed Scheme during its operational phase will have a negligible impact on the water environment.

15.5.4 A route-wide WFD compliance assessment is provided in Volume 3: Route-wide effects. This describes the measures embedded into the design that are specifically designed to ensure that the Proposed Scheme complies with the requirements of the WFD.

Assessment of impacts and effects

15.5.5 There are considered to be no significant adverse effects related to water resources and flood risk arising from operation of the Proposed Scheme.

Other mitigation measures

15.5.6 There are considered to be no further measures required to mitigate adverse effects on surface water resources, groundwater resources or flood risk.

Summary of likely residual significant effects

15.5.7 The assessment shows that there will be no residual significant effects on surface water, groundwater or flood risk during operation of the Proposed Scheme.

Cumulative effects

15.5.8 A review of the committed developments within the study area has identified no potential for significant cumulative permanent effects in the study area.

Monitoring

15.5.9 Volume 1, Section 9 sets out the general approach to monitoring of water resources and flood risk during operation of the Proposed Scheme.

15.5.10 There are no area-specific requirements for monitoring water resources and flood risk during the operation of the Proposed Scheme.

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