LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA22 | Whittington to Handsacre

November 2013

VOL 2

ES 3.2.1.22

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Department for Transport

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

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Structure of the HS2 Phase One Environmental Statement

The Environmental Statement (ES) documentation comprises:

- Non-technical summary (NTS) – which provides a summary in non-technical language of the Proposed Scheme, the likely significant environmental effects of the Proposed Scheme, both beneficial and adverse, and the means to avoid or reduce the adverse effects;
- Volume 1: Introduction to the ES and the Proposed Scheme – this describes High Speed Two (HS2), and the environmental impact assessment process, the approach to consultation and engagement, details of the permanent features and generic construction techniques as well as a summary of main strategic and route-wide alternatives and local alternatives (prior to 2012) considered;
- Volume 2: Community forum area reports and map books – 26 reports and associated map books providing a description of the scheme and of environmental effects in each area;
- Volume 3: Route-wide effects – provides an assessment of the effects of the Proposed Scheme where it is not practicable to describe them within the CFA descriptions in Volume 2;
- Volume 4: Off-route effects – provides an assessment of the off-route effects of the Proposed Scheme;
- Volume 5: Appendices and map books – contains supporting environmental information and associated map books; and
- Glossary of terms and list of abbreviations – contains terms and abbreviations, including units of measurement, used throughout the ES documentation.

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

1.1.2 HS2 is proposed to be built in two phases. Phase One, the subject of this ES, will involve the construction of a new railway line of approximately 230km (143 miles) between London and Birmingham. Construction will begin in 2017 and the line will become operational by 2026; with a connection to the West Coast Main Line (WCML) near Lichfield and to the existing HS1 railway line in London.

1.1.3 During Phase One, beyond the dedicated high speed track, these high speed trains will connect with and run on the existing WCML to serve passengers beyond the HS2 network to destinations in the north. A connection to HS1 will also allow some services to access that high speed line through east London and Kent and connect with mainland Europe via the Channel Tunnel.

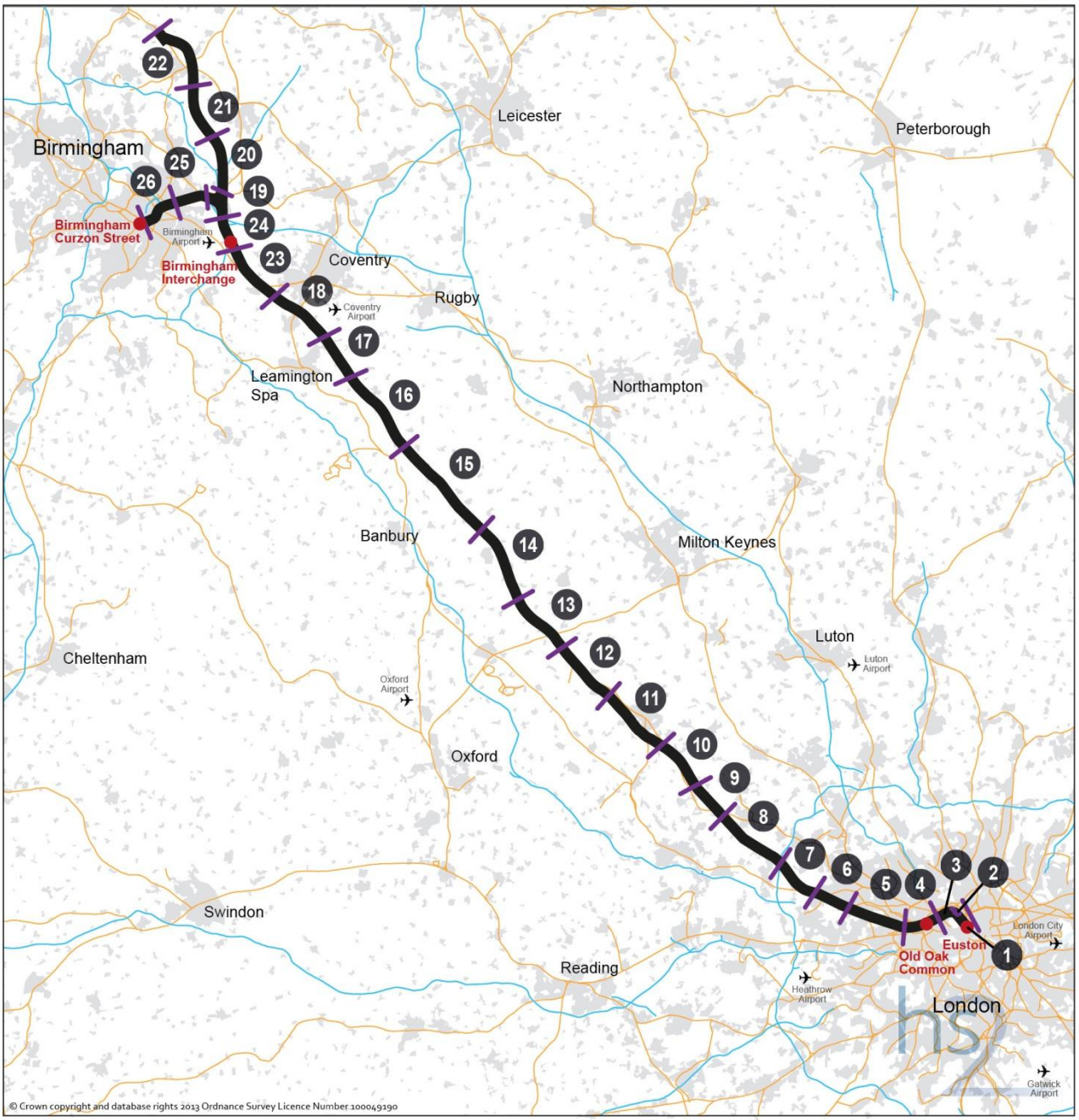
1.1.4 Phase Two will involve the construction of lines from Birmingham to Leeds and Manchester, with construction commencing approximately 2023, and planned to be operational by 2033.

1.1.5 Section 4 of Volume 1 describes the anticipated operational characteristics of HS2, including the anticipated frequency of train services. As Volume 1 shows, the frequency of trains is expected to increase over time and to increase further upon opening of Phase Two. In assessing the environmental effects of the Proposed Scheme the anticipated Phase 2 operational frequency has been used. For further detail of the anticipated operation of the Proposed Scheme in the Whittington to Handsacre area (CFA22), see Section 2.4.

1.1.6 The Government believes that the HS2 network should link to Heathrow and its preferred option is for this to be built as part of Phase Two. However, the Government has since taken the decision to pause work on the Heathrow link until after 2015 when it expects the Airports Commission to publish its final report on recommended options for maintaining the country's status as an international aviation hub.

1.1.7 For consultation and environmental assessment purposes, the proposed Phase One route has been divided into 26 community forum areas (CFA), as shown in Figure 1. This has enabled wider public engagement on the Proposed Scheme and on the likely adverse and beneficial effects.

Figure 1: HS2 Phase One route and community forum areas



Community forum areas

1. Euston - Station and Approach
2. Camden Town and HS1 Link
3. Primrose Hill to Kilburn (Camden)
4. Kilburn (Brent) to Old Oak Common
5. Northolt Corridor
6. South Ruislip to Ickenham
7. Colne Valley
8. The Chalfonts and Amersham
9. Central Chilterns
10. Dunsmore, Wendover and Halton
11. Stoke Mandeville and Aylesbury
12. Waddesdon and Quainton
13. Calvert, Steeple Claydon, Twyford and Chetwode
14. Newton Purcell to Brackley
15. Greatworth to Lower Boddington
16. Ladbroke and Southam
17. Offchurch and Cubbington
18. Stoneleigh, Kenilworth and Burton Green
19. Coleshill Junction
20. Curdworth to Middleton
21. Drayton Bassett, Hints and Weeford
22. Whittington to Handsacre
23. Balsall Common and Hampton-in-Arden
24. Birmingham Interchange and Chelmsley Wood
25. Castle Bromwich and Bromford
26. Washwood Heath to Curzon Street

HS2 station
Proposed Phase One route
CFA boundary
Existing railways
Motorways
Airports

0 20 km approx

1.2 Purpose of this report

1.2.1 This CFA report presents the likely significant effects of the construction and operation of the Proposed Scheme on the environment within CFA22 (Whittington to Handsacre). The report describes the mitigation measures that are proposed for the purpose of avoiding, reducing or managing the likely significant adverse effects of the Proposed Scheme on the environment within CFA22.

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 area, description of the Proposed Scheme within the area and its construction and operation, and a description of the main local alternatives;
- Sections 3-13 – an assessment for the following environmental topics:
  - agriculture, forestry and soils (Section 3);
  - air quality (Section 4);
  - community (Section 5);
  - cultural heritage (Section 6);
  - ecology (Section 7);
  - land quality (Section 8);
  - landscape and visual assessment (Section 9);
  - socio-economics (Section 10);
  - sound, noise and vibration (Section 11);
  - traffic and transport (Section 12); and
  - water resources and flood risk (Section 13).

1.3.2 Each environmental topic section comprises: an introduction to the topic; a description of the environmental baseline within the area; the likely significant environmental effects arising during construction and operation of the Proposed Scheme; and proposed mitigation measures for any significant adverse effects.

1.3.3 Environmental effects have been assessed in accordance with the methodology set out in Volume 1, the Scope and Methodology Report (SMR) (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2).

1.3.4 Where appropriate, potential climate change impacts and adaptation measures are discussed in the relevant environmental topic section. Volume 1 and Section 6A of the SMR Addendum also include additional information about climate change adaptation and resilience.

1.3.5 The maps relevant to Whittington to Handsacre are provided in a separate corresponding document entitled Volume 2: CFA22 Map Book, which should be read in conjunction with this report.

1.3.6 The Proposed Scheme described in this report is that shown on the Map Series CT05 (construction) (Volume 2: CFA22 Map Book) and CT-06 (operation) (Volume 2, CFA22 Map Book). 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, and this flexibility is included within the scope of the environmental assessment. Further explanation is provided in Volume 1, Section 1.4.

1.3.7 In addition to the environmental topics covered in Sections 3-13 of this report, electromagnetic interference is addressed in Volume 1 and climate (greenhouse gas emissions and carbon) and waste and material resources are addressed in Volume 3. An assessment of potential environmental effects beyond the CFAs has also been undertaken and this 'off-route' assessment is reported in Volume 4.

2 Overview of the area and description of the Proposed Scheme

2.1 Overview of the area

2.1.1 The Whittington to Handsacre CFA covers approximately 11.5km of the Proposed Scheme in the district of Lichfield in Staffordshire, where it passes approximately 1km to the east of Lichfield to connect with the West Coast Main Line (WCML) at Handsacre. The area extends from the parish of Whittington in the south, near DMS Whittington (Whittington Barracks), through Streethay, Fradley and Kings Bromley, to its northern boundary at Handsacre. The area includes all or part of the parishes of Whittington, Lichfield, Fradley and Streethay, Curborough and Elmhurst, Kings Bromley, Longdon, and Armitage with Handsacre.

2.1.2 The area is the northerly section of the Proposed Scheme (see Volume 4 for 'off-route' works on the WCML). The northern extent includes the WCML between A515 Lichfield Road and B5013 Lichfield Road in Handsacre and, consequently, modifications to the WCML railway in this area. The southern boundary is defined as the A51 Tamworth Road at Whittington Heath. For the purposes of this ES, properties fronting the A51 north of the junction with Jerry's Lane and Common Lane at Whittington Heath are taken to fall within this area rather than the Drayton Bassett, Hints and Weeford area (CFA21), which lies to the south as shown in Figure 2.

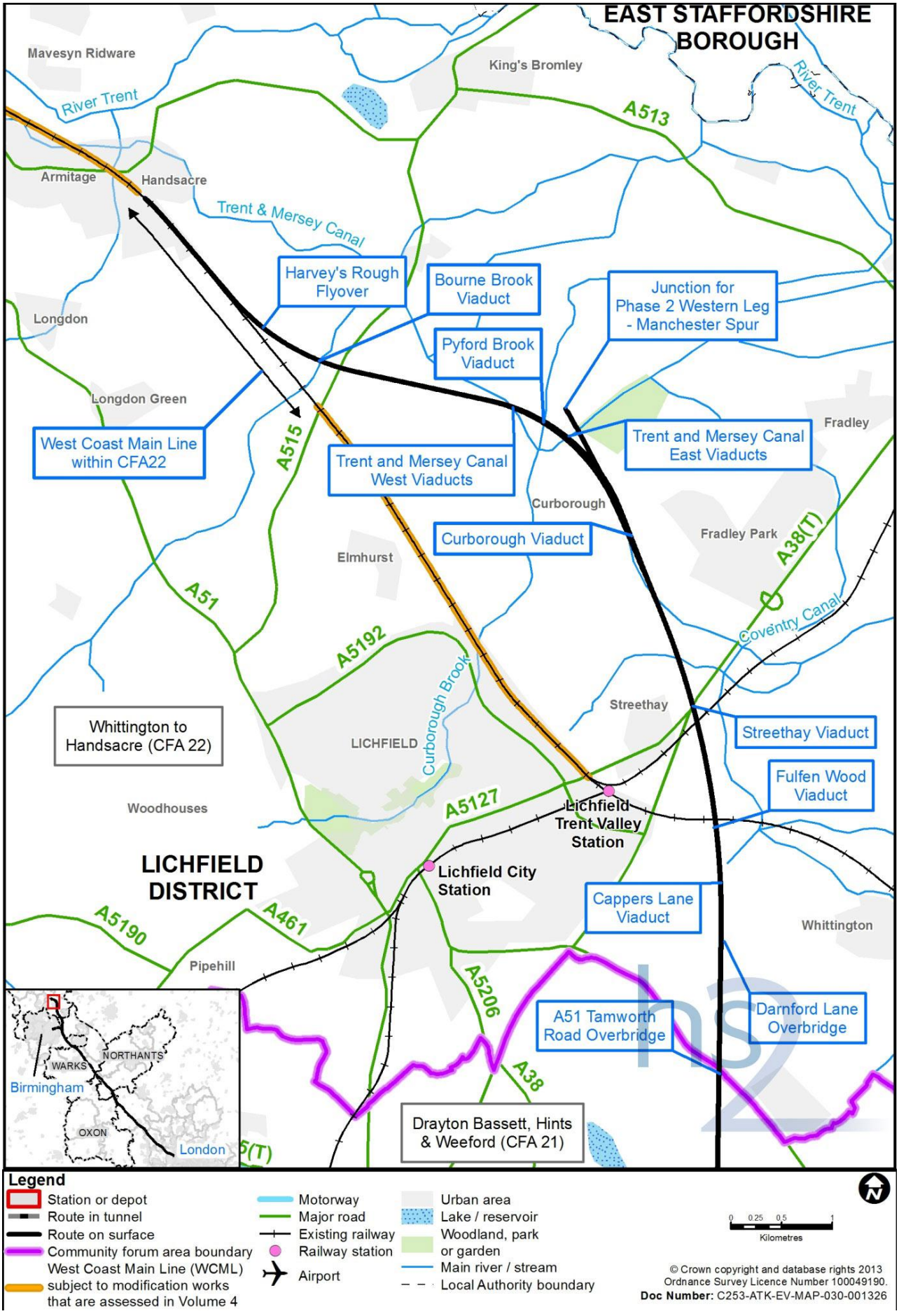
Settlement, land use and topography

2.1.3 The Whittington to Handsacre area is predominantly rural in character, with the exception of Fradley Park, a substantial business park, and the town of Handsacre. Agriculture is the main land use; mostly arable on the drier ground of the southern part of the area, with more grazing on the wetter ground in the northern part of the area. Within this pattern there are smaller pockets of land associated with horse grazing, market gardening and farming practices involving extensive use of polytunnels[1]. The agricultural land is interspersed with small villages, hamlets and isolated properties, but is also close to several larger settlements (see Maps CT-10-61b to CT-10-65, Volume 2, CFA22 Map Book).

2.1.4 The landform between Whittington and Handsacre is broadly defined by the raised heath plateau at Whittington sloping north-westwards down towards Streethay and skirting the river valley of the River Trent. In the valley, the river terraces create gentle and shallow slopes around the eastern edge of Lichfield that are characterised by some small pockets of steeper slopes around other brooks and streams. Away from the valley, the north-western fringes of Lichfield begin to rise to meet the high ground of Cannock Chase, away to the west.

[1] A polytunnel is a large tunnel made of polythene and used as a greenhouse. Collins English Dictionary. Complete & Unabridged 10th Edition. 2009 © William Collins Sons & Co. Ltd.

Figure 2: Area context map



Key transport infrastructure

2.1.5 The A38 connects Birmingham and Sutton Coldfield in the south to Lichfield and Fradley before continuing north to Burton upon Trent and Derby. The A515 links Lichfield with Kings Bromley, acting as an arterial route through the countryside west of Alrewas and Burton on Trent. The A51 runs west from Tamworth along the southern edge of the area to Lichfield and then continues north-west to Rugeley and along the Trent valley. Wood End Lane provides a busy link between the A38 and the A515, serving the business park at Fradley. The WCML runs north-west past Lichfield, through Handsacre and continues along the Trent valley. The South Staffordshire railway line runs north-east through Lichfield and connects with the WCML railway to the east of the city before continuing on past Fradley and Alrewas. All of these road and rail routes will be crossed by the Proposed Scheme.

2.1.6 There is a well developed network of public rights of way (PRoW) in the area, although there are no promoted recreational routes. There are also towpaths along the Coventry Canal and the Trent and Mersey Canal. The Coventry Canal passes through Whittington and Huddlesford and to the east of Streethay and past Fradley to join the Trent and Mersey Canal at Fradley Junction. At its nearest point, the towpath will be adjacent to construction works and will come within 150m of the route. The Trent and Mersey Canal passes through Fradley Junction and swings north-west near Wood End Lane at Fradley, passing Kings Bromley Marina and the north-east edge of Handsacre to the Trent valley. The Proposed Scheme will cross the Trent and Mersey Canal at three points on its bend north of Wood End Lane.

2.1.7 The Sustrans National Cycleway Route No. 54 passes through the area. The route connects Lichfield with Fradley and Alrewas to the north, and runs along the existing highways of Netherstowe Lane, east of Curborough and Gorse Lane at Fradley Park. The cycleway will be crossed by the route just west of the Wood End Lane / Gorse Lane junction.

2.1.8 In total, the Proposed Scheme will cross seven PRoW, plus one canal towpath and one on-road cycle route in this area.

Socio-economic profile

2.1.9 To provide a socio-economic context for the area, data for the demographic character areas (DCA) of Lichfield East and Whittington, Fradley and Armitage with Handsacre are used[2]. In total, the population of the DCAs is approximately 18,000. The area's labour market outperforms England's as a whole; unemployment at a low of 4% in Fradley DCA and a high of approximately 6% in Armitage with Handsacre DCA, which is significantly lower than the national level of approximately 7%[3].

Notable community facilities

2.1.10 Of the communities that lie closest to the route, Whittington and Handsacre have the greatest range of facilities and local services. Whittington, in the southern part of the area, has shops that meet day-to-day needs, including a pharmacy, a post office, a convenience food store, a coffee shop, hairdresser, and an estate agent. There is also

[2] A DCA represents a community that, depending on the area, may consist of a local ward, neighbourhood or village(s).
[3] All data comes from the 2011 Census.

a primary school, a branch GP surgery, a church, a hospice and a number of community halls in the village. The village is the centre of the catchment for some facilities, notably the primary school, which includes the southern part of the area as well as the Hints and Weeford communities, which fall within the adjoining Drayton Bassett, Hints and Weeford (see CFA21) area to the south.

2.1.11 Also in the south, a small community has established around DMS Whittington, a Ministry of Defence establishment. There is a children's day care nursery at the barracks, which is a public facility. Family living accommodation extends around the eastern side of the barracks. There are also playing fields to the north and east of the barracks, which at present are used regularly by a local football club. The Whittington Arms public house is situated on the south side of the A51 Tamworth Road to the west of the barracks, whilst the Whittington Heath Golf Club lies on the north side of the road.

2.1.12 The small village of Huddlesford has a public house beside the Coventry Canal but has no other community facilities. The Proposed Scheme crosses Cappers Lane at the Lichfield Cruising Club, which is based at Huddlesford and has moorings along both the Coventry Canal and the remaining section of the Wyrley and Essington Canal at Cappers Lane Bridge.

2.1.13 Lichfield is the main centre for many of the communities within the area. With the exception of the Handsacre and Kings Bromley communities, all of the villages in the area fall within the catchment for secondary schools at Lichfield. Streethay lies just north-east of Lichfield and has a public house and local shop. Fradley Park lies to the north of Streethay; the Proposed Scheme will pass between Streethay and the business park.

2.1.14 There are a number of attractions and recreational facilities in the area, including the visitor centre and public house on the Trent and Mersey Canal at Fradley Junction and the craft/antiques centre at Curborough.

2.1.15 Handsacre, in the north of the area, merges with the adjoining settlement of Armitage and has a small number of shops, including a baker, butcher, pharmacy, newsagent and a greengrocer/convenience store. There is a primary school on the southern edge of Handsacre and a child care day nursery. The combined area of Armitage with Handsacre also has a number of community halls, churches, open spaces and public houses, as well as a local police station and a GP surgery.

Recreation, leisure and open space

2.1.16 Whittington Heath Golf Club is just north of A51 Tamworth Road in the south of the area. As described above, there is a visitor centre on the Trent and Mersey Canal at Fradley Junction, Midland Karting and the Curborough Sprint Course just off Wood End Lane, the Dragonara Miniature Horse Stud and the Delta Force Paint Ball facility, which uses land at Vicar's Coppice.

2.1.17 To the east of Streethay and the A38 there is an equestrian centre at Streethay Farm, which offers riding lessons to the general public. Land adjacent to the equestrian centre is used as an airfield for recreational flying and a number of aircraft are based at the site. The runways lie directly in the line of the route of the Proposed Scheme.

2.1.18 Boat mooring facilities are available at various locations on the canals in the area. The Coventry Canal is served by moorings at Huddlesford, on the nearby Wyrley and Essington branch, at the recently opened Kings Orchard Marina (consent for 130 berths), at Streethay Wharf (65 berths, plus boat hire, boat building and maintenance) and near Fradley Junction. The Trent and Mersey Canal is served by moorings at and near Fradley Junction, either side of Wood End Lock and at the Kings Bromley Marina, (approximately 275 berths). The Proposed Scheme will be close to berths at the first five locations and within 500m of berths at the Kings Bromley Marina. There is also a static caravan site, Kingfisher Holiday Park, adjacent to Fradley Junction.

Policy and planning context

Planning framework

2.1.19 Given that HS2 is being developed on a national basis to meet a national need it is not included or referred to in many local plans. Nevertheless, in seeking to consider the Proposed Scheme in the local context, relevant local plan documents and policies have been considered in relation to environmental topics.

2.1.20 There are a number of key planning designations in the area, which include green belt, conservation areas, listed buildings, scheduled monuments, important archaeological sites, historic parks and gardens and ancient woodland. These are shown on the maps in CT-10-061b to CT-10-065.

2.1.21 Emerging policies are not generally considered within this report, unless a document has been submitted to the Secretary of State for approval, as is the case with the Lichfield District Local Plan – Our Strategy (which encompasses Lichfield District Council), submitted to the Secretary of State for examination in March 2013, with a schedule of proposed modifications[4].

Committed development

2.1.22 Developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme, are shown on Map CT-13-061b to CT-13-065 and listed in Volume 5 Appendix CT-004-000. Except where noted otherwise in Appendix CT-004-000, it has been assumed that these developments will have been completed by 2017. These are termed 'committed developments' and are treated as potential receptors from the Proposed Scheme. Where these developments have a particular relevance to an assessment topic, this is noted in the future baseline section for that topic. The following developments are relevant to several topic assessments in this area:

- ref: 11/00425/FULM – Regimental Headquarters (Mercian Regiment) Defence Medical Services (DMS) Whittington, Tamworth Road, WS14 9PY. Demolition of selected buildings and redevelopment of DMS Whittington to create a mixed use military development comprising education and training, office, storage and museum facilities with ancillary residential, recreational/social accommodation and related car parking, access, servicing and landscaping;

[4] Lichfield District Council (2012), *Lichfield District Local Plan Our Strategy July 2012 (Proposed Submission) and Schedule of Proposed Modifications to the Local Plan: Strategy Proposed Submission March 2013.*

- ref: 13/00574/FULM – Defence Medical Services Whittington Barracks, Tamworth Road, Whittington Heath, Lichfield. Refurbishment of the existing grassed sports pitches and installation of a synthetic football/hockey pitch and erection of 3 and 5m high fencing and eight floodlighting columns.
- ref: 11/00922/COU – Whittington Hill Farm, Darnford Lane, Darnford, Lichfield, Staffordshire WS14 9JQ. Conversion of workshop/stables to form a 3 bedroom ancillary residential unit;
- ref: 12/01040/FUL – The Plough Inn, Huddlesford Lane, Huddlesford, Lichfield, Staffordshire WS13 8PY. Installation of sewage pumping station and associated drainage and a gas storage tank;
- ref: 11/00928/OUTM – Land for Employment Development, Burton Old Road, Lichfield. Employment development (B1(a), (B1(c) light industrial, B8 storage and distribution, B2 general industry and ancillary offices, access improvements and associated landscaping and engineering works (extension of time for application);
- ref: 07/00774/OUTM and 11/00272/OUTM – Land at Easthill Farm, Wood End Lane, Fradley, WS13 8NF. Industrial and warehouse development (use class B1, B2, B8) with ancillary offices, associated gatehouses, car parking and servicing, landscaping, roads and footpaths (extension of time for application);
- ref: 07/00562/FULM – Canal Marina at Streethay Farm, Broad Lane, Huddlesford, Lichfield, Staffordshire. Construction of marina, erection of service and toilet blocks, landscaping, provision of ancillary services and alterations to access track (consent for 130 berths);
- ref: 11/00272/OUTM – Land at Easthill Farm Wood End Lane, Fradley, Lichfield, Staffordshire WS13 8NF. Industrial and warehouse development (use class B1, B2, B8) with ancillary offices, associated gatehouses, car parking and servicing, landscaping, roads and footpaths (Extension of time for application 07/00774/OUTM);
- ref: 12/00609/REM – Land at Easthill Farm, Wood End Lane, Fradley, Lichfield, Staffordshire WS13 8NF. Industrial and warehouse development (use class B1, B2, B8) with ancillary offices (approval of structural landscape areas in respect of Zones A, B and C);
- ref: 11/00561/FUL – Curborough Hall Farm, Watery Lane, Curborough, Lichfield, Staffordshire WS13 8ES. Formation of 3 no. stock ponds and associated breeding tanks (part retrospective);
- ref: 12/00343/FULM – Site and premises at former Lucas Varity PLC, Wood End Lane, Fradley, Lichfield, Staffordshire. Erection of two portal framed industrial buildings comprising transport workshop, industrial unit and offices (B2, B8) and associated works;
- ref: 10/01403/REMM – Land at Fradley Park, Halifax Avenue/Wood End Lane, Fradley. Mixed use development (Phase 4) comprising warehousing/manufacturing units with ancillary offices, medical centre,

nursery and office park and all associated works; and

- ref: 11/00135/FUL – Hanch Hall Farm, Lichfield Road, Armitage, Rugeley, Staffordshire WS13 8HQ. Erection of a livestock, produce and implement store.

2.1.23 To the east of Lichfield (Streethay) land is allocated in the emerging, but not yet adopted, Lichfield District Local Plan for a mixed use urban extension. This proposal is the subject of an outline planning application to Lichfield District Council which has not yet been determined. Part of the site to which the application relates lies within land that is required for the construction or operation of the Proposed Scheme. As a consequence representations have been made by HS2 Ltd to the Council confirming the intention to establish a dialogue with the developer to co-ordinate the interaction between the proposed urban extension development and the Proposed Scheme

2.1.24 Where such developments lie wholly or partly within the land required for the Proposed Scheme it is assumed that these will not be commenced or completed in their proposed form. These are noted in Volume 5: Appendix CT-004-000 and referred to in the relevant topic sections.

2.1.25 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. They are not included in the assessment. The progress of these proposals is being monitored by Hs2 Ltd. and appropriate action will be taken, if they are approved.

HS2 Phase Two

2.1.26 Within this area, the junction and a short length of the route for the western leg of the Phase Two route (Manchester spur) form part of the Proposed Scheme.

2.1.27 Whilst the detail of design and construction for Phase Two has not been developed, it is anticipated that, if Phase Two proceeds, then it is likely to start in 2023 or 2024 and that construction would continue for up to nine years, although works in this area would not necessarily be carried out for that entire period. The Phase Two works may therefore overlap with the commissioning period of Phase One. Any effects from construction of Phase Two on receptors in this area would be described in the Phase Two ES.

2.2 Description of the Proposed Scheme

2.2.1 The following section describes the main features of the Proposed Scheme in the Whittington to Handsacre area, including the main environmental mitigation measures. Further generic information on typical permanent features is provided in Volume 1, Section 5. Similarly, a general description of the approach to mitigation is set out in Volume 1, Section 9.

2.2.2 The Proposed Scheme will require some land on a permanent basis, key features of which are illustrated on Volume 2: CFA22 Map Book, Maps CT-06-123 to CT-06-130a. Land that will also be required, but only on a temporary basis for construction, is set out in Section 2.3 and illustrated on Volume 2: CFA22 Map Book, Maps CT-05-123 to CT-05-130a.

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

2.2.4 Since the draft ES was published, the following changes have been introduced to permanent features of the Proposed Scheme:

- The design for the Streethay construction sidings has been developed further and now includes an area of reception sidings set to the north alongside the South Staffordshire Line, with a temporary connection over the Trent and Mersey Canal. There is also a connection to the WCML. The design development has also allowed the area required for temporary stockpiling of excavated material to be considerably reduced, so that this will now be limited to the land west of the Coventry Canal;
- The A515 Lichfield Road crossing has been changed from an overbridge to an underbridge with only minor realignment needed to the existing road. This change has also enabled the temporary realignment of the road needed during construction to be shorter and aligned to the north, rather than the long temporary realignment to the south previously required through Vicar's Coppice; and
- Passing places have been incorporated along the remaining length of Shaw Lane.

Overview

2.2.5 The Proposed Scheme through this area will be approximately 11.5km in length. From A51 Tamworth Road, the route initially crosses Whittington Heath Golf Club proceeding north over Lichfield Road, Whittington and then under Darnford Lane just to the east of Whittington Hill Farm. With Lichfield to the west, the route curves to the north-west passing over a minor watercourse, a canal, Cappers Lane, Broad Lane and the WCML. The route then continues to the east of Streethay, passing over the South Staffordshire Line and the A38.

2.2.6 The route passes to the west of the Fradley Business Park, crossing over Wood End Lane. The proposed spur provided in Phase One for the Phase Two route (Manchester spur) commences alongside Fradley Park. The southbound rail line from Handsacre passes over the Manchester spur. The line to Handsacre curves tighter towards the west, crossing over the Trent and Mersey Canal twice, Curborough Brook (via the Pyford Brook viaduct), and through Ravenshaw Wood. As the route crosses over Kings Bromley Footpath 0.392 it curves back toward the north-west, crossing over the existing A515 Lichfield Road, Bourne Brook and Shaw Lane. The Proposed Scheme will connect with the WCML to the south of Handsacre. It is currently envisaged that the construction of the Manchester spur will end just to the north of the Trent and Mersey Canal. The Manchester spur will include the junction off the Phase One line, plus a length of the Phase Two route towards the north-west sufficient to allow construction of Phase Two of HS2 to be built without affecting the operation of Phase One.

2.2.7 See Volume 1 for descriptions of typical rail corridor, embankments and viaducts (Sections 5.2, 5.3 and 5.10 respectively).

A51 Tamworth Road to Cappers Lane

2.2.8 The Proposed Scheme enters this area in a cutting approximately 8.5m deep under the A51 at Whittington Heath Golf Club. This section the Proposed Scheme will be in cutting or on embankment with underpasses for Whittington Footpath 16 and Lichfield Road and an overbridge for Darnford Lane, as the route starts to fall towards the Trent valley.

2.2.9 Key features of this section, which is approximately 1.8km long, will include (see Volume 2: maps CT-06-123 to CT-06-124):

- a 330m cutting (continued from Drayton Bassett, Hints and Weeford area (CFA21)) with a maximum depth of up to 9m at the A51 Tamworth Road overbridge;
- an embankment for approximately 830m reaching a maximum height of approximately 10m, with an underbridge for the Lichfield Road, which will remain on its existing alignment;
- a cutting for approximately 350m to a maximum depth of approximately 3m crossed by the Darnford Lane overbridge,approximately40m north of the existing road; and
- an embankment approximately 375m long up to Cappers Lane viaduct, with a maximum height of approximately 14.5m.

2.2.10 Landscape earthworks with landscape mitigation planting will be provided from Lichfield Road to Cappers Lane viaduct. Whittington Footpath 16 will be realigned to a proposed underpass in Whittington Heath Golf Club. Sandy Lane (also Whittington bridleway 17) will be diverted for a short distance along the route of Footpath 16 to Lichfield Road. A drainage pond will be provided on the east side of the route (see Volume 2, CT-06-124-D6).

2.2.11 Within this area, modifications to the WCML between A515 Lichfield Road and B5014 Lichfield Road will include installation of new track switches, crossovers, signalling equipment, a permanent access road and a relocatable equipment building.

Cappers Lane to Streethay

2.2.12 The Proposed Scheme will continue north predominantly on embankment, up to 16m in height, including two viaducts. This section will be approximately 1.6km long (Volume 2: CFA22 Map Book, Maps CT-06-124, D6 to CT-06-125, D6). Key features of this section include:

- an approximately 215m long viaduct with noise barriers over Cappers Lane and the Wyrley and Essington canal at a maximum of approximately 16.5m above ground level;
- embankment approximately 350m long (see Volume 2: map CT-06-124, C6 to A6) from Cappers Lane viaduct with a maximum height of over 16m. The embankment includes an underbridge to cross Broad Lane on its existing alignment (see Volume 2: map CT-06-124, A6 to A7);
- Fulfen Wood viaduct approximately 100m long and with noise fence barriers,

crossing over the WCML (see Volume 2: map CT-06-125, I5);

- an embankment approximately 900m long (see Volume 2: map CT-06-125, H5 to D6) and with a maximum height of approximately 16m, including an underpass for Fradley and Streethay Footpath 6 and an access track for Hill Farm (see Volume 2: map CT-06-125, E5 to E6). The footpath will be realigned to the north of its existing route;
- a viaduct approximately 270m long over the South Staffordshire Line and over the A38 and its slip roads (see Volume 2: map CT-06-125, D6); and
- realignment of the A38 northbound slip road (see Volume 2: map CT-06-125, D7 to B5).

2.2.13 Landscape earthworks with landscape mitigation planting will be provided from Cappers Lane to the South Staffordshire Line on both sides of the route. Woodland habitat creation areas will be provided on both sides of the route as will hedgerow habitat creation on the west side of the route between Broad Lane and the South Staffordshire Line. The earthworks created for provision of the temporary construction sidings will remain alongside the South Staffordshire Line and in the area between the route and the A38. Landscape planting will be provided along these areas.

2.2.14 A drainage pond and auto-transformer station will be provided to the west of the route north of Cappers Lane (see Volume 2: map CT-06-124, B7 to C7). A balancing pond to the west of the route north of the WCML (see Volume 2: map CT-06-125, G6) will also be provided.

Streethay to the Trent and Mersey Canal.

2.2.15 The Proposed Scheme continues north predominantly on embankment, up to 14m in height. This area includes the grade separated spur for the Phase Two line to the north-west. The approximate length of this section will be 3.8km. Key features of this section include (Volume 2: CFA22 Map Book, Maps CT-06-125 to CT-06-128):

- an embankment of approximately 2.3km long (see Volume 2: map CT-06-126, J3 to CT-06-127, H7) with a maximum height of approximately 14m, from the Streethay viaduct to existing Wood End Lane (see Volume 2: map CT-06-127, D6). About 1km south of Wood End Lane, the embankment will widen to accommodate four tracks on the approach to the junction with the Phase Two western leg (Manchester spur), Manchester Line and will include an underpass for the realigned Wood End Lane;
- just north of the existing Wood End Lane on embankment, the connection to the WCML at Handsacre will diverge from the Phase Two main line. As the tracks diverge the eastern (southbound) track will rise up on embankment to a maximum height of 14m;
- a flyover structure of approximately 170m long will carry the southbound track over the main line tracks, retaining walls will be provided where the tracks are at different heights;
- an embankment will continue further for approximately 850m with a

maximum height of 8m to form the spur of the Proposed Scheme for Phase Two to Manchester (Manchester spur) and will include a 100m long viaduct over the Trent and Mersey Canal (See Volume 2: CT-06-127, D5); the extent of the Phase One railway works will stop approximately 200m to the north of the canal (see Volume 2: CT-06-127, B4);

- two embankments approximately 400m long, with the southbound track up to 17m high and the northbound track up to 5m high; the two tracks will be separated by a retaining wall;
- two viaducts approximately 70m long over the Trent and Mersey Canal, with a distance of approximately 35m between them(see Volume 2: CT-06-127, C6);
- two viaducts approximately 80m long over Curborough Brook via Pyford Brook viaduct, with a distance of approximately 20m between them (see Volume 2: map CT-06-127, B6);
- viaducts approximately 130m long over the Trent and Mersey Canal, with two joined decks to accommodate the converging tracks (see Volume 2: map CT-06-128, H5); and
- embankments will be provided between this series of viaducts, descending from approximately 14m to 9m; where the tracks are at different levels, retaining walls will be provided between the tracks, which become parallel and at the same level just beyond the Trent and Mersey Canal west viaducts.

2.2.16 Landscape earthworks with landscape mitigation planting will be provided from the A38 to the existing Wood End Lane on the west side of the route, including planting to connect to the existing woodland areas on either side of the route. Approximately 600m north of the A38 and north of Mare Brook, an area for ecological mitigation will be provided to the west of the route (see Volume 2: map CT-06-126, H4 to D5).

2.2.17 A drainage pond and a package substation will be provided to the east of the route (see Volume 2: CT-06-126, H3 to G3). An underpass will be provided for the permanent realignment of Alrewas Footpath 31 (see Volume 2: CT-06-126-C5 to C4). Mare Brook will be diverted to new north and south culverts. Access roads to the west side of the Proposed Scheme will be provided to the new Mare Brook culverts (see Volume 2: CT-06-126-J6 to H4 and CT-06-126-E5). Access to the east side of the Proposed Scheme will be provided just south of Nanscawan Road (see Volume 2: CT-06-126-E3).

2.2.18 Wood End Lane will be permanently realigned under the route approximately 300m to the south of its existing alignment and in slight cutting (see Volume 2: CT-06-127, E7 to H5) with two highway drainage balancing ponds for the realigned lane, which will also require a pumping station to the east of the route. A railway drainage pond will be provided to the north of the realigned Wood End Lane (see Volume 2: CT-06-127, G7). An auto-transformer station will be located adjacent to the south-east of the Trent and Mersey Canal (see Volume 2: CT-06-127, D6). A new junction with Netherstowe Lane will be provided (see Volume 2: CT-06-127, F8) as well as new access roads to the balancing ponds, businesses in the hangars, the sprint circuit and an existing farm (see Volume 2: CT-06-127, H6).

Trent and Mersey Canal to the WCML

2.2.19 From the Trent and Mersey Canal west viaducts, the Proposed Scheme will continue west on embankment, up to 13.2m in height, to the tie-in with the WCML. The WCML tie-in will be provided via a grade separated junction to the south of Handsacre. The approximate length of this section is 4.3km. Key features of this section include:

- an embankment of 1.9km (see Volume 2: map CT-06-128, H5; to map CT-06-129, G7), varying in height from approximately 3m to 12m at its northern end, through Ravenshaw Wood and Black Slough;
- a viaduct approximately 125m long over Bourne Brook (see Volume 2: map CT-06-129, G7 to F7);
- an underbridge for the A515 (see Volume 2: map CT-06-129, H7 to G6) constructed over the line of the existing road (see Volume 2: map CT-06-129, G6 to G7);
- an embankment approximately 550m long and approximately 13m high with a retaining wall on the west side (see Volume 2: map CT-06-129, F7 to C6);
- a junction between the WCML and HS2, with the two easternmost tracks of the WCML realigned approximately 40m to the east of their current position at the point where HS2 will cross the WCML. Realignment will be for approximately 1.6km from the A515 Lichfield Road to the southern end of Handsacre, with the existing rail earthworks widened;
- the 130m long Harvey's Rough flyover carrying the HS2 tracks over the two realigned WCML tracks to join;
- an embankment, approximately 500m long, descending from 9m high to the same level as the existing WCML – the HS2 tracks would then converge with the central WCML tracks with the railway junction having six tracks for approximately 1km until the tie-in point (see Volume 2: CT-06-129, F6); and
- a short length of the two western WCML tracks will be realigned approximately 2m to the west and will require a low retaining wall.

2.2.20 Landscape earthworks in some locations and extensive landscape mitigation planting will be provided from the Trent and Mersey Canal to just south of Handsacre on both sides of the route. Larger areas of landscape mitigation plantings will be provided south and north of A515 Lichfield Road on the west side of the route, in the angle between HS2 and the WCML, and on the east side of the route at the HS2 and WCML junction. Several lengths of hedgerow habitat creation will be provided (see Volume 2: map CT-06-130a, J6 to A5) and there will be extensive areas of woodland habitat creation to offset the loss of ancient woodland in this area and provide connectivity between the remaining areas of existing woodland (see Volume 2: map CT-06-128, F6 to C9 and B7 to A7; map CT-06-129, I7 to H7 and F7 to E7). Landscape planting will be provided on both sides of the realigned WCML (see Volume 2: map CT-06-130a, J6 and J7 to E6 and E7).

2.2.21 Access roads will be provided south of the A515 Lichfield Road near the proposed underpass for the Kings Bromley Footpath 0.392 underpass (see Volume 2: map CT-

06-129, I6 to I7). Shaw Lane will be stopped up between the WCML and Tuppenhurst Lane (see Volume 2: map CT-06-130a, D5 to D8) and a balancing pond and access will be provided south of Shaw Lane. The existing WCML underpass for the Kings Bromley Footpath 6 underpass (see Volume 2: map CT-06-130a, H6) will be extended. A balancing pond and access will be located on the west side of the WCML south of Handsacre (see Volume 2: map CT-06-130a, F7 toE6).

2.2.22 In addition to the realignment of the WCML, work will be undertaken to modify signalling, power supplies and access for the new junction. Works associated with the WCML in the Whittington to Handsacre area include the construction of a permanent access route to a new relocatable equipment building adjacent to the WCML. This access, which follows an existing track for part of its length, will leave Spode Avenue, Handsacre, and follow the east and south boundary of Hayes Meadow Primary School (see Volume 2, Map CT-06-130a, D6 to C5).

2.2.23 Other modifications to the WCML to the south of A515 Lichfield Road and to the north of the B5014 Lichfield Road in Handsacre are addressed in Volume 4: Off-route works.

2.3 Construction of the Proposed Scheme

2.3.1 This section sets out the strategy for construction of the Proposed Scheme in the Whittington to Handsacre area, including:

- overview of the construction process;
- description of the advance works;
- description of the engineering works to build the railway;
- construction waste and material resources;
- commissioning the railway; and
- indicative construction programme.

2.3.2 The assessment presented in this ES is based on the construction arrangements as described in this section.

2.3.3 In addition to the land that will be required permanently by the Proposed Scheme (see Section 2.2), land will be required on a temporary basis for construction. Key temporary construction features are illustrated on the Volume 2: CFA22 Map Book, Maps CT-05-123 to CT-05-126. Following construction works, land required temporarily will be prepared for its eventual end use, which will include being returned to its pre-construction use, wherever appropriate.

2.3.4 A guide to standard construction techniques is provided in Volume 1, Section 6. In instances for which more than one possible construction technique might be possible, this section specifies which technique has been assumed for the purposes of the assessment.

Overview of the construction process

2.3.5 Building and preparing the railway for operation will comprise the following general stages:

- advance works, including: site investigations further to those already undertaken; preliminary mitigation works; preliminary enabling works;
- civil engineering works, including: establishment of construction compounds; site preparation and enabling works; main earthworks and structure works and site restoration;
- railway installation works, including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the existing rail network; and site restoration; and
- system testing and commissioning.

2.3.6 General provisions relating to the construction process are set out in more detail in Volume 1, Section 6.4, and Section 4 of the draft Code of Construction Practice (CoCP) (see Volume 5: Appendix CT-003-000) including:

- the approach to environmental management during construction and the role of the Code of Construction Practice (draft CoCP, Section 4);
- working hours (draft CoCP, Section 5);
- the management of construction traffic (draft CoCP, Section 14); and
- the handling of construction materials (draft CoCP, Section 15).

Advance works

2.3.7 General information about advance works can be found in Volume 1, Section 6.5. Advance works will be required before commencing construction works and will typically include:

- further detailed site investigations and surveys;
- further detailed environmental surveys;
- advance mitigation works including, where appropriate, contamination remediation, habitat creation and translocation, and built heritage survey and investigation;
- highways works;
- demolitions;
- site establishment with temporary fence construction; and
- utility diversions.

Engineering works

2.3.8 Construction of the railway will require engineering works along the entire length of the route, and within land adjacent to the route. This will comprise two broad types of engineering work:

- civil engineering works, such as earthworks and erection of bridges and viaducts; and/or

- railway installation works, such as laying ballast or slabs and tracks, and/or installing power supply and communications features.

2.3.9 The construction of the Proposed Scheme will be subdivided into sections, each of which will be managed from compounds. The construction 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, which are generally smaller. Some compounds will be used for civil engineering works and others for railway installation works, and in some cases for both.

2.3.10 In the Whittington to Handsacre area there will be two main compounds, nineteen civil engineering satellite compounds, one construction siding, one railway main compound, and two roadheads. There will be an additional three rail system satellite compounds in CFA22 for auto-transformer installation works at Lyntus and at Cappers Lane and for the installation of a package substation in Mare Brook and a rail systems main compound at Handsacre junction, with access off the A515, for works to the WCML. The A51 Tamworth Road package substation satellite compound is located on the boundary of CFA22 and CFA21 and is reported in CFA21. The Handsacre rail systems main compound will also manage three satellite compounds for the WCML modifications beyond this area (see Volume 4) and the rail works for Streethay construction sidings.

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

General overview of construction compounds

2.3.12 Main compounds will be used for core project management staff (i.e. engineering, planning and construction delivery) and commercial and administrative staff. These management teams will directly manage some works and/or coordinate satellite compounds, which will manage other works. In general, main compounds will contain:

- space for the storage of bulk materials (aggregates, structural steel and steel reinforcement);
- space for the receipt, storage and loading/unloading of excavated material either onto or off the site;
- an area for the fabrication of temporary works equipment and finished goods;
- fuel storage;
- plant and equipment storage; and
- office space for management staff, limited car parking for staff and site operatives, and welfare facilities.

2.3.13 Satellite compounds will be used as the base to manage specific works along a section of the route. They will usually provide office accommodation for limited numbers of staff, local storage for plant and materials, limited car parking for staff and site operatives, and welfare facilities.

2.3.14 Some compounds will also accommodate additional functions as listed below. Where this is the case they will be included in the description of the compound:

- railheads will connect with the existing railway network for the delivery of materials for the construction of the rail systems; further details are provided in Section 2.3.34;
- construction sidings will connect with the existing railway network to enable loading and unloading to and from trains delivering material to the HS2 site or removing excavated material; further details are provided in Section 2.3.36;
- roadheads will require an area of land for the storage and loading and unloading of bulk earthworks materials which are moved to and from the site on public highways; and
- living accommodation for the construction workforce.

2.3.15 In addition, areas adjacent to some compounds will be used for the storage of topsoil stripped as part of the works prior to it being used when the land is reinstated to its former use.

2.3.16 Further information on the function of compounds, including general provisions for their operation including security fencing, lighting, utilities supply, site drainage, codes of worker behaviour are set out in Volume 1, Section 6.3 and the draft CoCP, Section 5.

Construction traffic routes

2.3.17 The movement of construction vehicles carrying materials, plant, other equipment and workforce (or moving empty) will take place both within the construction sites, on public roads and via the rail network. The construction compounds will provide the interface between the construction works and the public highway or rail network, and the likely road routes to access compounds are described in subsequent sections below.

2.3.18 Movements between the construction compounds and the work sites will be on designated haul roads within the site, often along the line of the Proposed Scheme or running parallel to it.

Figure 3: Schematic of construction compounds for civil engineering works

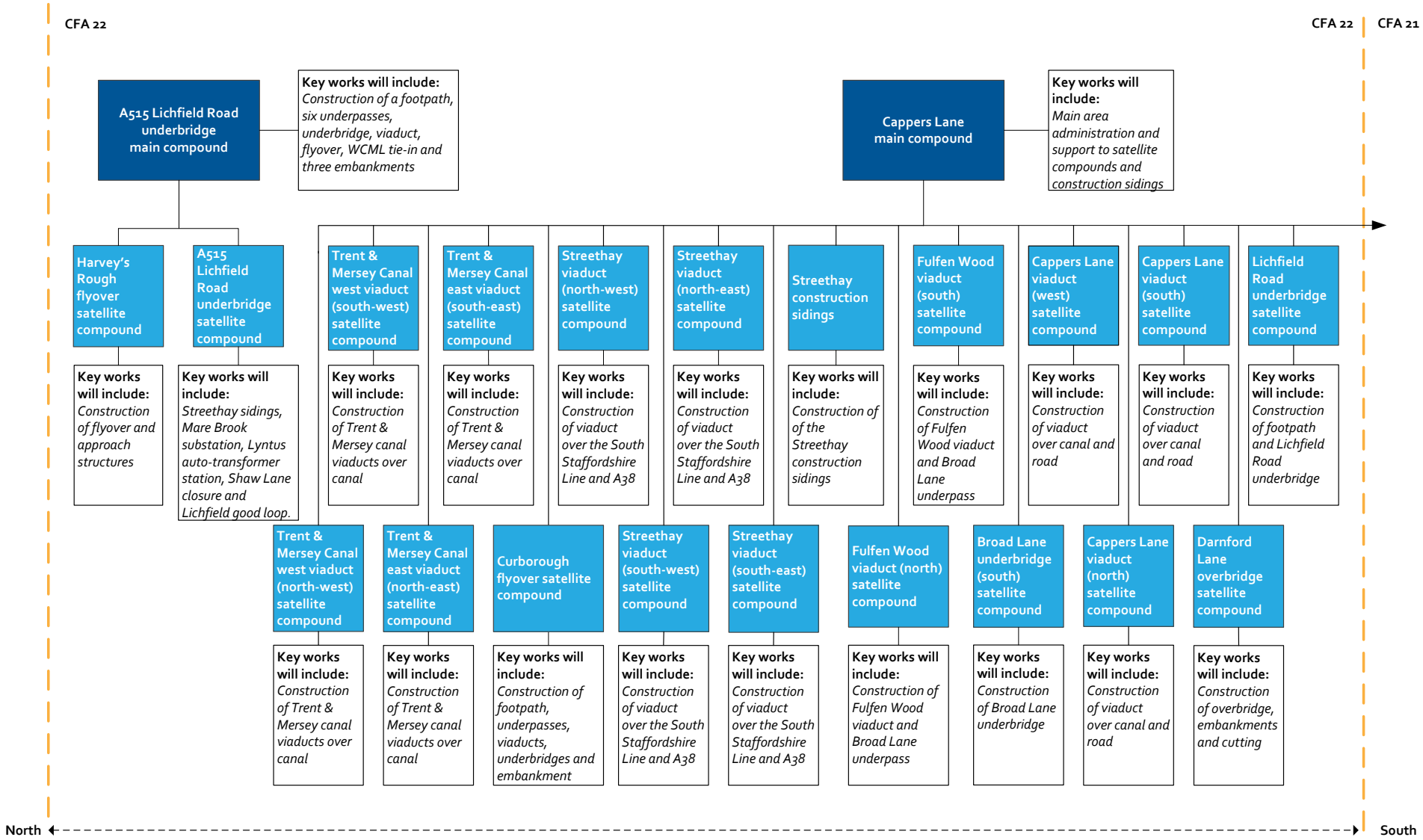
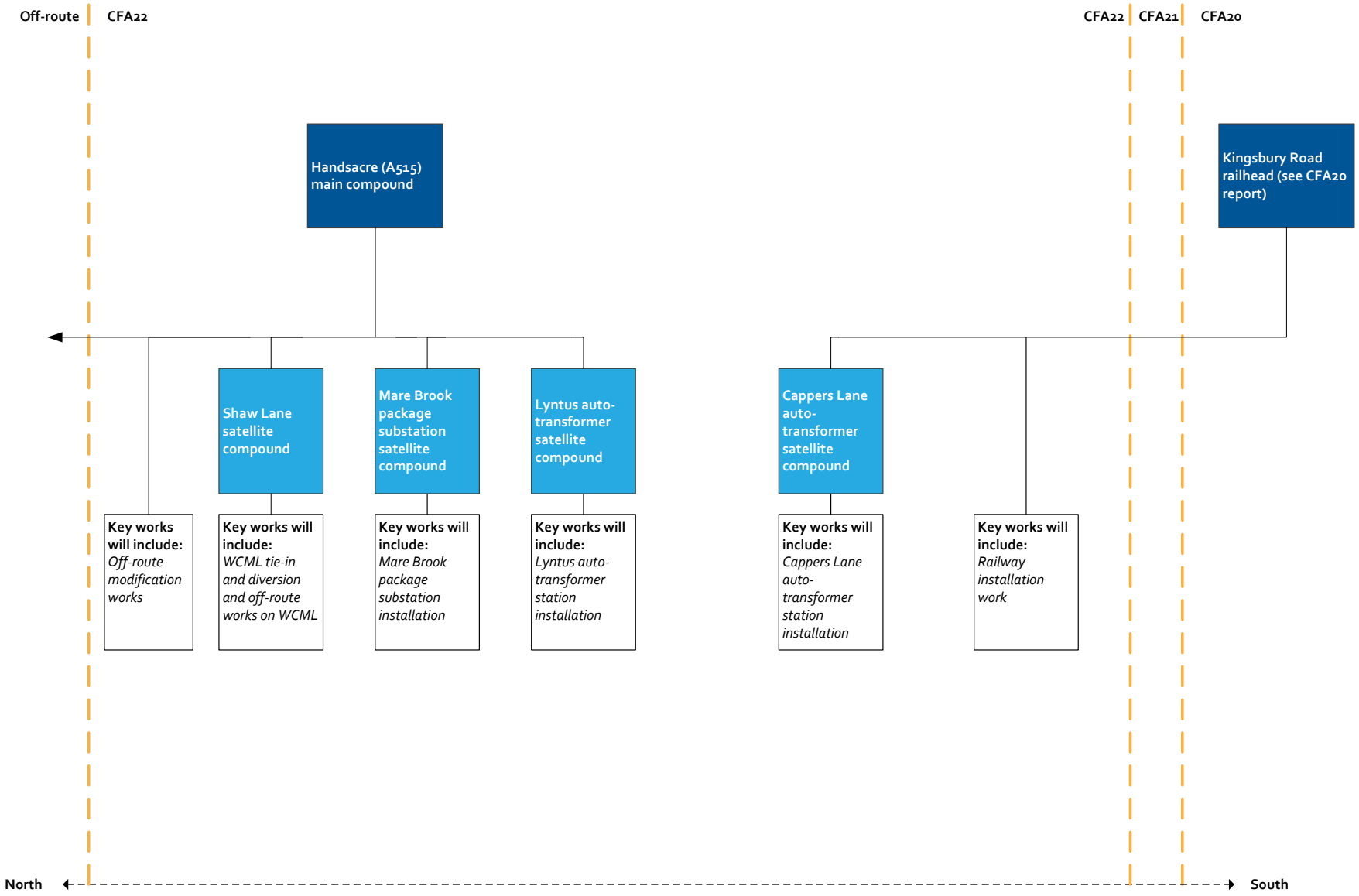


Figure 4: Schematic of construction compounds for railway installation works



Rail services and installation works compounds

Cappers Lane main compound (Map CT-05-125, I8 to H10)

2.3.19 This compound will comprise the main area administration and support for construction works in the Whittington to Handsacre area between the Lichfield Road underbridge satellite compound to the Trent and Mersey Canal west viaducts (north-west) satellite compound, as well as construction works in the Drayton Bassett, Hints and Weeford area between the Hints Footpath 14 green overbridge satellite compound to the Swinfen cutting roadhead. The compound will be established in 2018 and be operational for approximately six years. There will be an average of 105 workers and a peak of 180 workers.

2.3.20 The Cappers Lane main compound will manage the following principal works in this area in addition to the support facilities identified in paragraph 2.3.28:

- earthworks (embankments and cuttings); and
- mitigation planting and landscape earthworks.

2.3.21 Finalisation works will include landscaping and planting.

Demolitions

2.3.22 The buildings that will need to be demolished in this area are listed in Table 1.

Table 1: Demolition works for the portion of CFA22 managed from the Cappers Lane main compound (up to Trent and Mersey Canal west viaduct (north-west)

Description of buildings	Location
Whittington Heath Golf Club, A51 Tamworth Road, Whittington. Club house and one other building (total buildings demolished – 2)	Map CT-05-123,F6
Ellfield House, Darnford Lane, Whittington. Two outbuildings (total buildings demolished – 2)	Map CT-05-124, G6
Ivy Cottage, Broad Lane. One outbuilding (total buildings demolished – 1)	Map CT-05-124, B7
Hill Farm, Orchard Road, Streethay. Two residential properties and six other buildings (total buildings demolished – 8)	Map CT-05-125, F6 to F7
Airfield buildings, Streethay Farm, Burton Road. Eight buildings (total buildings demolished – 8)	Map CT-05-125, D5 to C5
Streethay Cottage, Elverceter and Field Cottage, Burton Road, Streethay. Three residential properties and two other buildings (total buildings demolished – 5)	Map CT-05-125,B6 to B7
Rough Stockings. One residential property and one outbuilding (total buildings demolished – 2)	Map CT-05-126, H3
Ravenshaw Wood. Two outbuildings (total buildings demolished – 2)	Map CT-05-128, D6

Highways and road realignments

2.3.23 Within the Whittington to Handsacre area, nine roads will be diverted, realigned and/or subject to traffic management measures during construction of the Proposed Scheme as follows (illustrated on the construction map series CT-05 (Volume 2: CFA22 Map Book):

- temporary realignment of Lichfield Road, Whittington for a period of approximately 11 months, while a new online underpass is built;

- permanent realignment of Darnford Lane with new offline overbridge to the north;
- Cappers Lane, minor disruption (overnight closure during deck erection);
- temporary realignment of Broad Lane for a period of approximately 10 months, while a new online underpass is built;
- permanent realignment of the A38 northbound slip road; and
- permanent realignment of Wood End Lane with a new offline underbridge to the south.

2.3.24 In most cases overnight or weekend closures will be required to complete the tie-in of the new and existing highways.

2.3.25 Construction of the Streethay Viaduct over the A38 and its slip roads will be coordinated with the realignment of the A38 northbound slip road. The structure will be constructed using standard construction techniques. To maintain safe operation of the dual carriageway it will be necessary to undertake the works under traffic management, which will operate for a period of approximately six years on the A38 and its slip roads, and is likely to include temporary speed restrictions for safety and temporary use of the hard shoulder to provide adequate working space; reduced lane widths may also be used at times. To safely install the bridge decks over the carriageway it will be necessary to close the carriageway overnight during these works.

Railways

2.3.26 The construction of the crossings of the WCML and South Staffordshire Line will use standard construction techniques. To maintain safe operation of the railway some works will be undertaken during planned overnight and weekend closures of the railway.

2.3.27 The installation of the bridge decks over these railway will be undertaken during weekend closures of the railway. These will be planned to coincide with other works being undertaken on the railway by HS2 or others where possible.

PRoW realignments

2.3.28 The following PRoW will be realigned in the Whittington to Handsacre area:

- temporary realignment of Whittington Footpath 16 for a period of approximately 5 months for construction of new underpass and permanent realignment close to its current route;
- temporary realignment of Sandy Lane (also known as Whittington Bridleway 17) for a period of approximately 10 months, then permanent diversion onto Lichfield Road and through the new underbridge;
- temporary stopping up of Streethay Footpath 6 for a period of approximately six years between Streethay and the Coventry Canal, then permanent reinstatement in a new underpass north of the existing route;
- temporary realignment of an unnumbered footpath through Streethay Farm

outside the temporary siding connection track for a period of approximately six years in an underpass below the siding connection track;

- permanent realignment of Alrewas Footpath 31 in a new underpass north of its existing route;
- temporary realignment of Alrewas Footpath 44 around piers during construction of viaduct; and
- minor adjustments to the Trent and Mersey canal and towpath will be made to allow a safe route around the works during installation of the bridge decks over the railway.

Utilities

2.3.29 Numerous utilities will need to be diverted for the works, the principal diversions being:

- high voltage electricity plants as follows:
  - 400kV overhead electricity transmission line where the route passes between two towers at Fulfen Wood, towers to be moved approximately 150m north to Hill Farm and the A38 where the height requirements are less; and
  - The overhead electricity transmission line works will also require access to modify pylons remote from the diversion.
- Large-diameter water mains as follows:
  - 12inch water main of strategic importance with restricted outages, at Wood End Lane; and
  - 18inch water distribution main along Wood End Lane to be realigned along with Wood End Lane.

Watercourse diversions

2.3.30 The Proposed Scheme includes the following changes to watercourses:

- realignment of unnamed watercourse to Fulfen Wood culvert (Volume 2: CFA22 Map Book, Map CT-06-125, G5); and
- realignment of Mare Brook to new peripheral drainage ditches/watercourses both sides of proposed embankment and to Mare Brook north culvert (Volume 2: CFA22 Map Book, Map CT-06-126, E4).

2.3.31 Works to construct the viaducts over the Trent and Mersey canal and Coventry canal will be undertaken through management of traffic flows and with the provision of protection decks over the canal. There may be an occasional need to close the canals overnight to safely construct some of the works.

Finalisation works

2.3.32 Finalisation works will include landscaping and planting.

Satellite construction compounds

2.3.33 Eighteen satellite construction compounds will be managed from the Cappers Lane main compound, to construct the works in this area. Table 2 details the principal construction activity, start date, approximate duration, number of workers and highway access route for each associated programme.

Table 2: Satellite construction compounds managed by the Cappers Lane main compound

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (ave/peak)	Highways access route
Lichfield Road underbridge satellite compound (Map CT-05-124, I7)	Construction of Whittington Footpath 16 underpass and Lichfield Road underbridge	2018	1 year	14/20	Lichfield Road to A51 Tamworth Road to A38
Darnford Lane overbridge satellite compound (Map CT-05-124, F5)	Construction of Darnford Lane overbridge, Whittington Heath / Huddlesford embankments and Whittington Common cutting	2018	3 years	18/30	Haul route to Cappers Lane
Cappers Lane viaduct (south) satellite compound (Map CT-05-124, D6)	Construction of Cappers Lane viaduct over canal and road	2017	2 years	20/30	Cappers Lane to the A38
Cappers Lane viaduct (north) satellite compound (Map CT-05-124, C6)	Construction of Cappers Lane viaduct over canal and road	2017	2 years	30/30	Cappers Lane to A38
Cappers Lane viaduct (west) satellite compound (Map CT-05-124, C7)	Construction of Cappers Lane viaduct over canal and road	2017	2 years	20/30	Cappers Lane to A38
Broad Lane underbridge satellite compound (Map CT-05-124, B6)	Construction of Fulfen Wood viaduct over WCML and Broad Lane underbridge	2017	2.5 years	20/30	Cappers Lane main compound and haul route
Fulfen Wood viaduct (south) satellite compound (Map CT-05-125, I4 and I5)	Construction of Fulfen Wood viaduct over WCML and Broad Lane underbridge	2018	2.5 years	55/80	Cappers Lane main compound and haul route
Fulfen Wood viaduct (north) satellite compound (Map CT-05-125, H5)	Construction of Fulfen Wood viaduct over WCML and Broad Lane underbridge	2018	2.5 year	20/30	Cappers Lane main compound and haul route
Streethay viaduct (south-east) satellite compound (Map CT-05-125, D5)	Construction of Streethay viaduct over the South Staffordshire railway line and A38	2019	2 years	20/30	Track/haul route via Cappers Lane Main Compound
Streethay viaduct (north-east) satellite compound (Map CT-05-125, C5)	Construction of Streethay viaduct over the South Staffordshire railway line and A38	2019	2 years	20/30	Track/haul route via Cappers Lane Main Compound

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (ave/peak)	Highways access route
Streethay viaduct (south-west) satellite compound (Map CT-05-125, C6)	Construction of Streethay viaduct over the South Staffordshire railway line and A38	2019	2 years	20/30	Track/haul route via Cappers Lane Main Compound
Streethay viaduct (north-west) satellite compound (Map CT-05-125, C7)	Construction of Streethay viaduct over the South Staffordshire railway line and A38	2019	2 years	30/30	A38 northbound on slip road to track
Curborough flyover satellite compound (Map CT-05-127, F7)	Construction of Alrewas Footpath 31 underpass, Wood End Lane underbridge. Curborough flyover, Pyford Brook viaducts, Trent and Mersey Canal east viaducts and Streethay/Curborough embankments	2018	7 years	32/100	A38 to Wood End Lane and Netherstowe Lane
Trent & Mersey Canal east viaduct (south-east) satellite compound (Map CT-05-127, D7 to D8)	Construction of Trent and Mersey Canal east viaducts over canal	2018	1 year	70/100	A38 to Wood End Lane
Trent & Mersey Canaleast viaduct (north-east) satellite compound (Map CT-05-127, C5)	Construction of Trent and Mersey Canal east viaducts over canal	2018	1 year	20/30	Haul route via Trent and Mersey Canal east viaduct (south-east) satellite compound
Trent & Mersey Canal west viaduct (south-west) satellite compound (Map CT-05-127, A8)	Construction of Trent and Mersey Canal east viaducts over canal	2018	1 year	20/30	A38 to Wood End Lane
Trent & Mersey Canal west viaduct (north-west) satellite compound (Map CT-05-128, H5)	Construction of Trent and Mersey Canal west viaducts over canal	2018	1 year	30/30	Haul route via Trent & Mersey Canal west viaduct (south-west) satellite compound.

Roadheads

2.3.34 Roadheads are areas for the storage and loading and unloading of bulk earthworks material which is moved to and from the site on public highways.

2.3.35 There will be two roadheads managed from the Cappers Lane main compound within the Whittington to Handsacre area:

- the Nanscawen Road East and Westbound roadhead is to the north-east of the existing Wood End (Volume 2: CFA22 Map Book, Map CT-05-126, G5-6, F5-6 and E5) and will be operational for approximately three years beginning in 2018; and

- the Wood End Lane Eastbound roadhead is to the northeast of Wood End Lane (Volume 2: CFA22 Map Book, Map CT-05-127, F6-7, E6-7 and D6-7) and will be operational for approximately three years beginning in 2019.

2.3.36 Material arriving at the roadheads in this area will arrive from either the north or south via Wood End Lane. The Nanscawen Road East and Westbound roadhead will be accessed from Nanscawen Road to Wood End Lane to the A38. The Wood End Lane Eastbound roadhead will be accessed from Wood End Lane to the A38.

Streethay construction sidings

2.3.37 Streethay construction sidings will receive bulk excavated material by rail from elsewhere on the Proposed Scheme. The sidings will be used to transfer the material into vehicles for movement into the required locations for construction of the Proposed Scheme, using both the on-site haul routes and public roads, as appropriate. The main access to the construction sidings will be from the east using Park Lane/Broad Lane to a haul road along the WCML to Cappers Lane to the A38. Provision will also be made for direct on and off access from the A38 southbound. The access to the reception siding will be provided from Brookhay Lane.

2.3.38 The sidings will comprise four main elements:

- an area of reception sidings alongside the South Staffordshire Line (Map CT-05-125-R1, B4 to C8) into which trains can be accepted from either direction without having to wait on the existing tracks, for subsequent movement into the main sidings area for unloading; the reception sidings will also be used for the holding and dispatch of empty trains back onto the network, in either direction, without disrupting existing service patterns;
- an area of sidings between Hill Farm and the A38 (Map CT-05-125, D6 to G8), into which the full trains will be moved for unloading. The empty trains will then either return to the reception sidings or leave by joining the WCML southbound;
- a railway track that links the two areas of sidings, by means of a temporary bridge over the Coventry Canal, at a level that will not interfere with users of the canal or its towpath (Map CT-05-125, D6 to Map CT-05-125-R1, C8); and
- a stockpile area between the offload sidings and the Coventry Canal, which will provide capacity to store some of the material passing through this site in order to accommodate differences in the rates of material arriving and leaving.

2.3.39 The construction sidings will take approximately one year to construct and will be operational from 2018 for a period of approximately four and half years. The material stockpile on the site will continue to be operational for a further year (approximate) after this time. The site will be decommissioned after the works, over a period of approximately six months.

2.3.40 Train movements between the reception sidings and the South Staffordshire Line, or out onto the WCML, could occur at any time, but unloading of the trains will be undertaken within the working hours set out in the draft CoCP.

A515 Lichfield Road underbridge main compound (Map CT-05-129,G5 to H6)

2.3.41 This main construction compound will comprise the main area administration and support facilities for construction works in the northern part of the area, north of Trent and Mersey canal west viaduct. The compound will also support construction of Kings Bromley Footpath 0.392 and six underpasses, A515 Lichfield Road underbridge, Bourne Brook viaduct, Harvey's Rough flyover, WCML tie-in and Ravenshaw Wood / Shaw Lane / Lilac embankments. The compound will be established in 2018 and will be operational for approximately five and half years. There will be an average of 91 workers and a peak of 150 workers.

Demolitions

2.3.42 The buildings that will need to be demolished in this area are listed in Table 3.

Table 3: Demolitions in CFA22 managed by the A515 Lichfield Road underbridge main compound (from Trent and Mersey Canal west viaduct to the B5014 Lichfield Road in Handsacre)

Description of buildings	Location
Hanchwood House, Shaw Lane, Handsacre. One dwelling and three outbuildings (total buildings demolished –4)	Map CT-05-129, G7

Highways and road realignments

2.3.43 Within this part of the Whittington to Handsacre area, two roads will be diverted, realigned and/or subject to traffic management measures during construction of the Proposed Scheme as follows (illustrated on the construction map series CT-05 (Volume 2: CFA22 Map Book):

- temporary realignment of the A515 Lichfield Road to the north of the current alignment for a period of approximately one and half years, for construction of a new online underbridge; and
- a section of Shaw Lane of approximately 340m will be stopped up at the existing crossing of the West Coast Main Line with traffic diverted west to A515 Lichfield Road.

2.3.44 In most cases overnight or weekend closures will be required to complete the tie in of the new and existing highways

Railways

2.3.45 Works to construct the new junction between HS2 and the WCML will use standard construction techniques. This assessment is based on the following phased construction works:

- construct realigned lengths of WCML realigned eastern tracks and Harvey's Rough flyover away from the operational railway;
- connect and commission the realigned length of WCML and remove redundant existing WCML tracks;
- complete construction of HS2 embankment and tracks between WCML lines;
- to accommodate the new junction, the existing rail systems will also need to be modified, including signalling, power and communications; and

- where these works will affect the operational railway, they will be undertaken in planned non-disruptive night time and weekend closures of the WCML.

PRoW realignments

2.3.46 The following PRoW will be realigned in the Whittington to Handsacre area:

- permanent realignment of Kings Bromley Footpath 0.392 in a new underpass; and
- temporary closure of Kings Bromley Footpath 6 for approximately six months, with permanent reinstatement along its existing alignment in a new extended underpass.

Utilities

2.3.47 Numerous utilities will need to be diverted for the works, the principal diversions being:

- high voltage electricity plants as follows:
  - 400kV overhead electricity transmission line at Handsacre south of Shaw Lane with temporary diversion alongside the route;
  - 400kV overhead electricity transmission line at Handsacre south of Shaw Lane with replacement of existing towers to provide sufficient clearance over the route; and
  - the overhead electricity transmission line works will require access to modify towers remote from the diversion.
- large-diameter water mains as follows:
  - 33inch and 36inch water main diversion to new culvert below Bourne Brook viaduct near Hanchwood House, between A515 Lichfield Road and Shaw Lane; and
  - 600mm and 900mm water mains alongside route near Handsacre south and north of the A515 Lichfield Road.

Watercourse diversions

2.3.48 There will be two realignments of unnamed watercourses to two culverts.

Finalisation works

2.3.49 Finalisation works will include landscaping and planting.

Satellite construction compounds

2.3.50 Two satellite compounds will be managed from the A515 Lichfield Road underbridge main compound. Table 4 details the principal construction activity, start date, approximate duration, number of workers and highway access route for each associated programme.

Table 4: Satellite construction compounds managed by A515 Lichfield Road main compound

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
A515 Lichfield Road underbridge satellite compound (Map CT-05-129, G9 to G10)	Construction of A515 Lichfield Road underbridge	2018	1 year	20/30	A515 Lichfield Road underbridge main compound and haul route
Harvey's Rough flyover satellite compound (Map CT-05-129, D7 to D8)	Construction of Harvey's Rough flyover and approach structures to allow track crossovers to tie in to WCML	2018	five years	91/130	A515 Lichfield Road underbridge main compound and haul route

Temporary worker accommodation sites

2.3.51 Two temporary worker accommodation sites will be located within this section of the Proposed Scheme. The first site will be adjacent to the Cappers Lane main compound (Map CT-05-125, I9 and I10) and will comprise living accommodation, welfare facilities and car parking for 29 workers over a period of approximately six years. The second site will be adjacent to the A515 Lichfield Road underbridge main compound (Map CT-05-129, G9 and G10) and will comprise living accommodation, welfare facilities and car parking for approximately 30 workers over a period of approximately five years. Temporary worker accommodation will adhere to the mitigation measures set out within the draft CoCP.

Handsacre main compound (A515)

2.3.52 This compound will comprise the main area for administration and support for the Whittington to Handsacre rail installation works as well as the modifications to the WCML from Lichfield to Colwich. The compound will also help facilitate the WCML diversion and connection in Handsacre. The Handsacre (A515) compound will be retained during the testing and commissioning phase of the works and will be demobilised on completion of the HS2 Phase One works.

2.3.53 The Handsacre (A515) main compound will be established in 2021 and will be operational for approximately six years. It will be operational for two periods of works:

- modifications to the WCML from Lichfield to Colwich; these works will commence in 2021 and conclude in 2023; and
- diversion and connection to the WCML, as well as modifications to the WCML within the Whittington to Handsacre area which will commence in 2021 and conclude in 2027.

2.3.54 There will be an average of 93 workers and a peak of 125 workers.

2.3.55 The compound will be accessible from the A515 Lichfield Road. This will require a new permanent connection from the A515 Lichfield Road to an existing National Rail access road.

2.3.56 The railway systems installation works will include track, overhead power line equipment, communications equipment and traction power supply. The installation of track in open areas will comprise the laying of ballast and/ or slab tracks, rail and sleepers. Before the railway systems installation can commence, adequate civil engineering work will need to be completed to allow a continuous track laying sequence. The railway systems installation will have its own mobile welfare facilities for the site staff.

2.3.57 The compound will be used to manage the following key railway systems installation works in this section of the Proposed Scheme:

- Installation of a auto-transformer station;
- installation of an auxiliary substation; and
- HS2 track and rail systems will be installed from the Kingsbury Road railhead main compound.

2.3.58 On the WCML, the installation of new signal gantries and removal of redundant ones will be undertaken using a crane, sited on a temporary crane platform adjacent to the railway. Gantries will typically be lifted into place or removed overnight during temporary track possessions, in order to avoid disruption to rail services. The locations of the six crane platforms within the Whittington to Handsacre area (CFA22) are shown on Volume 2: Maps CT-05-129 and CT-05-130.

2.3.59 See Volume 1, Section 5 for descriptions of typical railway systems (Section 5.15 to 5.17), and Section 6 for associated construction activities (Section 6.13 and 6.23 to 6.25, respectively). See Volume 1, Section 5.16 for descriptions of typical power supply features, including auto-transformer stations, and Section 6.23 for associated construction techniques.

2.3.60 Finalisation works will include landscaping and planting.

Satellite construction compounds

2.3.61 Three satellite compounds will be managed from the Handsacre main compound. Table 5 details the principal construction activity, start date, approximate duration, number of workers and highway access route for the associated programme.

Table 5: Railway installation works satellite compounds managed by Handsacre (A515) main compound

Compound name	Principal construction activity	Start date	Estimated duration of use	Number of workers (average/peak)	Highways access route
Lyntus auto-transformer station satellite compound (Map CT-05-127, D6)	Facilitate the Lyntus auto-transformer station fit-out	2022	1 year	27/38	A38 to Wood End Lane
Mare Brook package substation satellite compound (Map CT-05-126, H3)	Facilitate the Mare Brook package substation fit-out	2022	4 weeks	2/4	A38 to Wood End Lane
Shaw Lane (Map CT-05-129, D7 to D8)	Modification works for WCML in CFA22 and for WCML works from Lichfield to Colwich	2021	2 years	55/65	A515 Lichfield Road/B5014 Lichfield Road/Shaw Lane

Railhead at Kingsbury Road

2.3.62 Kingsbury Road railhead (in CFA20) is the main compound for the rail systems installation from Long Itchington Wood tunnel to Handsacre connection, and to Birmingham Curzon Street.

2.3.63 The railway systems installation works will include track, overhead line equipment, communications equipment and traction power supply. The installation of track in open areas will be of standard ballast or slab track configuration.

2.3.64 The railway compound will facilitate the following activities:

- permanent way (ballast and/or slab track) installation;
- overhead line electrification installation;
- train control;
- signalling;
- telecommunication fit-out; and
- low-voltage line side power fit-out.

2.3.65 See the Volume 2 report for CFA20 for more details of the Kingsbury Road railhead.

Rail systems satellite compounds

2.3.66 The Kingsbury Road railhead will provide main compound support to one satellite compound required for rail systems installation works within the Whittington to Handsacre area, as shown in Table 6, with map references to Volume 2: CFA22 Map Book.

Table 6: Satellite rail systems compounds managed by the Kingsbury Road railhead

Compound name	Principal construction activity	Start date (year, quarter)	Estimated duration of use	Number of workers (average/peak)	Highways access route
Cappers Lane auto-transformer station satellite compound (Map CT-05-124, B7)	Facilitate the Cappers Lane auto-transformer station fit-out	2022	1 year	27/38	Cappers Lane

Construction waste and material resources

2.3.67 Forecasts of the amount of construction, demolition and excavation waste (CDEW) and worker accommodation site waste that will be produced during construction of the Proposed Scheme in the Whittington to Handsacre area have been prepared and are presented in Volume 5: Appendix WM-001-000.

2.3.68 The majority of excavated material that will be generated across the Proposed Scheme will be reused as engineering fill material or in the environmental mitigation earthworks of the Proposed Scheme, either with or without treatment.

2.3.69 Based on the mitigation earthworks design approach adopted for the Proposed Scheme, local excess or shortfall of excavated material within the Whittington to

Handsacre area will be managed 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.

2.3.70 The quantity of surplus excavated material originating from the Whittington to Handsacre area that will require off-site disposal to landfill as excavation waste is shown in Table 7. This is the forecast quantity of contaminated excavated material that is chemically unsuitable for re-use within the Proposed Scheme.

2.3.71 The quantities of demolition, construction and worker accommodation site waste that will be reused, recycled and recovered (i.e. diverted from landfill) have been based on the landfill diversion performance of similar projects as follows:

- demolition waste: 90%;
- construction waste: 90%; and
- worker accommodation site waste: 50%.

2.3.72 The quantities of demolition, construction and worker accommodation site waste that will require off-site disposal to landfill are shown in Table 7.

Table 7: Estimated construction demolition and excavation waste

Waste type	Estimated material quantities that will be generated (tonnes)	Estimated quantity of waste for off-site disposal to landfill (tonnes)
Excavation	2,026,575	0
Demolition	17,220	1,722
Construction	69,298	6,930
Worker accommodation sites	123	62
TOTAL	**2,113,216**	**8,714**

2.3.73 The assessment of the likely significant environmental effects associated with the disposal of CDEW and worker accommodation site waste has been undertaken for the Proposed Scheme as a whole (see Volume 3, Section 14).

Commissioning of the railway

2.3.74 Commissioning is the process of testing the infrastructure to ensure that it operates as expected and will be carried out in the period prior to opening. Further details are provided in Volume 1, Section 6.26.

Construction programme

2.3.75 A construction programme that illustrates indicative periods for the construction activities in this area described above is provided in Figure 5.

Figure 5: Indicative construction programme

Construction activity	2017 quarters				2018 quarters				2019 quarters				2020 quarters				2021 quarters				2022 quarters				2023 quarters				2024 quarters				2025 quarters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Advance works																																				
Advance works																																				
Civil engineering works																																				
Cappers Lane main compound																																				
Whittington Heath embankment																																				
Fulfen Wood south embankment																																				
Fulfen Wood north embankment																																				
Lichfield Road underbridge satellite compound																																				
Lichfield Road underbridge																																				
Darnford Lane overbridge satellite compound																																				
Whittington Common cutting																																				
Darnford Lane overbridge																																				
Huddlesford embankment																																				
Cappers Lane viaduct (south) (north) (west) satellite compound																																				
Cappers Lane viaduct																																				
Broad Lane underbridge (south) satellite compound																																				
Broad Lane underbridge																																				
Fulfen Wood viaduct (south) (north) satellite compound																																				
Fulfen Wood viaduct																																				
Broad Lane underbridge																																				
Streethay construction sidings																																				
Streethay construction sidings																																				
Streethay viaduct (south-east) (north-east) (south-west) (north-west) satellite compound																																				
Streethay viaduct																																				
Curborough flyover satellite compound																																				
Streethay embankment																																				
Wood End Lane underbridge																																				
Curborough flyover																																				
Curborough embankment																																				

Construction activity	2017 quarters				2018 quarters				2019 quarters				2020 quarters				2021 quarters				2022 quarters				2023 quarters				2024 quarters				2025 quarters			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Pyford Brook east embankment																																				
Pyford Brook viaducts																																				
Pyford Brook west embankment																																				
Trent & Mersey Canal east viaduct satellite compound (south-east) (north-east)																																				
Trent and Mersey Canal north viaduct (Manchester spur)																																				
Trent and Mersey Canal east viaducts																																				
Trent & Mersey Canal west viaduct satellite compound (south-west) and Trent & Mersey canal west viaduct satellite compound (north-west)																																				
Trent & Mersey Canal west viaducts																																				
A515 Lichfield Road underbridge main compound																																				
Streethay construction sidings																																				
A515 Lichfield Road underbridge																																				
Rail infrastructure and systems works																																				
Rail installation works (From Handsacre [A515] main compound)																																				
Lyntus ATS satellite compound																																				
Mare Brook package substation satellite compound																																				
Shaw Lane satellite compound																																				
Rail installation works (From Kingsbury Road railhead)																																				
Cappers Lane ATS satellite compound																																				
Commissioning																																				
Commissioning																																				

Key: Construction works Compound duration

2.4 Operation of the Proposed Scheme

Operational specification

2.4.1 Volume 1, Section 4.4 describes the envisaged operational characteristics of Phase One of HS2 as a whole and how they may change when Phase Two is also operational.

HS2 services

2.4.2 It is anticipated that initially and with Phase One in place there would be 8 trains per hour each way passing through the Whittington to Handsacre area in the morning and evening peak hours, and fewer during other times. The first trains of the day would leave the terminus stations no earlier than 05:00 Monday to Saturday (and 08:00 on Sundays) and the last would arrive no later than midnight.

2.4.3 It is anticipated that with Phase Two in place the frequency could rise to 12 trains per hour each way during peak hours, with 11 trains per hour each way on the Manchester route and one train per hour each way on the link to the WCML at Handsacre. The assessment of sound, noise and vibration has taken into account the frequency during Phase Two for the route as far as the junction for Phase Two western leg (Manchester spur), but the Phase One frequency for the link line to Handsacre.

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

Maintenance

2.4.5 Volume 1, Section 4.4 describes the maintenance regime for HS2.

Operational waste and material resources

2.4.6 Forecasts of the amount of operational waste that will be produced annually during operation of the Proposed Scheme have been prepared and are presented in Volume 5: Appendix WM-001-000.

2.4.7 Railway station and train waste refers to waste that will arise at each station. It will include waste from station operations and passenger waste removed from trains at terminating stations. This has only been reported for areas along the route in which these stations will be located.

2.4.8 Rolling stock maintenance waste is that which will be generated by the relevant train operating company at rolling stock maintenance facilities. This has only been reported for the areas along the route in which these facilities will be located.

2.4.9 Track maintenance waste and ancillary infrastructure waste (for example waste from depots, signalling locations, operations and maintenance sites) has been estimated using an average waste generation rate per kilometre length of total track. For this reason, both track maintenance waste and ancillary infrastructure waste has been reported for each area along the route.

2.4.10 The quantity of operational waste that will be reused, recycled and recovered (i.e. diverted from landfill) has been based on landfill diversion performance information from Network Rail and other sources as follows:

- railway station and trains: 60%;
- rolling stock maintenance: 80%;
- track maintenance: 85%; and
- ancillary infrastructure: 60%.

2.4.11 On this basis, approximately 219 tonnes of operational waste will be reused, recycled and recovered during each year of operation of the Proposed Scheme in the Whittington to Handsacre area. Approximately 45 tonnes will require disposal to landfill (see Table 8).

Table 8: Operational waste forecast for the Proposed Scheme in the Whittington to Handsacre area

Waste source	Estimated quantity of waste generated per annum (tonnes)	Estimated quantity of waste going to off-site disposal per annum (tonnes)
Railway station and trains	0	0
Rolling stock maintenance	0	0
Track maintenance	244	37
Ancillary infrastructure	20	8
TOTAL	**264**	**45**

2.4.12 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 (see Volume 3, Section 14).

2.5 Community forum engagement

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

2.5.2 The engagement undertaken within this community forum area is summarised below. A series of community forum meetings and discussions with individual landowners, organisations and action groups were undertaken. Community forum meetings were held on:

- 11 April 2012 at Armitage Village Hall;
- 28 June 2012 at Armitage Village Hall;
- 25 September 2012 at Armitage Village Hall;
- 8 November 2012 at Kings Bromley Village Hall;
- 28 February 2013 at Kings Bromley Village Hall; and
- 23 September 2013 at Kings Bromley Village Hall.

2.5.3 In addition to HS2 Ltd representatives, attendees at these community forum meetings typically included local residents and residents groups, public representatives, representatives of local authorities and parish and district councils, action groups, affected landowners and other interested stakeholders.

2.5.4 The main themes to emerge from these meetings were:

- impacts to community;
- impacts on ecology and wildlife;
- impacts to farming and associated farming businesses;
- use, size and location of works sites, impacts, construction traffic and use of local roadways, haul routes;
- visual impacts and blighting;
- mitigation measures;
- listed buildings;
- potential for route changes at the Trent and Mersey Canal, Cappers Lane and the junction for Phase 2 western leg (Manchester spur); potential for a tunnel between Whittington and Curborough;
- impacts to Handsacre and the mitigation proposed at the WCML junction;
- cumulative impacts with WCML in Armitage;
- impact to previously committed development at Fradley Park;
- noise/vibration effects, analysis of maximum noise rather than average levels;
- impacts on highways, traffic, traffic counts and public perception and access to Sandy Lane;
- total number of trains running through this area;
- connection to the existing Lichfield Trent Valley and Rugeley Trent Valley train service on WCML; and
- need for imported materials for embankment construction.

2.5.5 In addition to engagement through the community forums, the draft Environmental Statement and Design Refinement consultations were launched on 16 May 2013 for a period of eight weeks and closed on 11 July 2013. As part of these consultations, members of local communities and other interested parties were notified, provided with information and invited to engage on issues pertinent to the draft Environmental Statement and the development of the scheme. Details of the local consultation events were provided on the HS2 Ltd website, social media, posters at local venues, national and regional advertising and to properties within 1km of the Proposed Scheme. In the Whittington to Handsacre area consultations on the draft Environmental Statement and on the Design Refinement were held on 11 June 2013 at The Guildhall, Lichfield.

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

2.5.7 Responses from the draft Environmental Statement consultation have been analysed and an overview of those received and how the Environmental Statement has taken

account of responses is contained in the Draft Environmental Statement Consultation Summary Report (Volume 5: Appendix CT-008-000).

2.6 Route section main alternatives

2.6.1 The main strategic alternatives considered in this area of the Proposed Scheme are presented in Volume 1 and in Volume 5: Appendix CT-002-000. The main local alternatives considered for the Proposed Scheme within this area are described in this section.

2.6.2 Since April 2012, as part of the design development process, a series of local alternatives has been reviewed within workshops attended by engineering, planning and environmental specialists. During these workshops, the likely significant environmental effects of each design option have been reviewed. The purpose of these reviews has been to ensure that the Proposed Scheme draws the appropriate balance between engineering requirements, cost and potential environmental impacts.

Configuration of connection to West Coast Main Line at Handsacre

2.6.3 The January 2012 announced route included the connection of HS2 to the inner pair (fast) of four tracks of the WCML at Handsacre. In order to implement this scheme, all the existing four tracks of the WCML would need to be relocated to provide adequate space for the HS2 connections. This would cause significant operational disruption to the WCML, as the majority of the junction construction works are adjacent to or within the WCML operating area.

2.6.4 Alternative options have been investigated to reduce the overall impact of the WCML connection, to reduce disruption to the WCML and if possible to provide a more cost effective solution.

2.6.5 The following options were considered:

- Option A (January 2012 announced route) – HS2 would connect to the centre WCML (fast) tracks. It would be necessary to realign all four WCML tracks outwards to create sufficient space for the HS2 ramp and for construction. The realigned WCML lines would be lowered by approximately 1.5m in the area of the HS2 crossing;
- Option B – HS2 would connect to the central (fast) tracks of the WCML using an underpass. The WCML would be realigned asymmetrically so only the two eastern tracks of the WCML would be moved horizontally by approximately 30m and raised. The majority of the relocated WCML lines and the HS2 crossing could be constructed away from the operational railway before the tracks are realigned. In order to climb above the HS2 tracks, the new gradient for the WCML would prevent its use by freight;
- Option C– HS2 would connect to the central (fast) tracks of the WCML in a similar fashion to Option A. In this case the WCML would be realigned asymmetrically so only the two eastern up tracks of the WCML would be moved similar to Option B;

- Option D – HS2 would connect to the outer WCML (slow) tracks. No realignment of the WCML would be required. To achieve this, the northbound HS2 line would be required to cross all four WCML tracks on a skew crossing that would necessitate the construction of a bridge structure approximately 300m long. This structure would be constructed within the existing railway corridor during closures of the railway. This junction arrangement would require the link between HS2 Phase Two to Manchester and the WCML at Handsacre to be constructed on two separate embankments rather than a pair of tracks on a single embankment as in the announced route; and

- Option E – The layout of Option E would have direct HS2 connections to all four WCML tracks. This would allow the HS2 trains to join the slow and fast lines at 200kph without affecting the adjacent lines. The length of the structures over the WCML to achieve this would be approximately 350m. The WCML tracks would be realigned to allow construction of the structure which would have a major effect on WCML operations. The land required to construct and operate the Proposed Scheme would be significantly greater than the other options.

2.6.6 Option A would require the realignment of all four WCML tracks and would offer no other significant benefits over options which have less impact on the WCML.

2.6.7 Option B is not a viable option as it would restrict freight use on the WCML.

2.6.8 Option C could be constructed with the least impact on the WCML. It would, however, have a greater land requirement on the east side of the route at the junction.

2.6.9 Option D would require a large structure to be constructed over the WCML and would require more railway night-time and weekend closures than Option C. The separation of the link between the main HS2 route and the WCML onto two separate viaducts would increase the environmental impacts on woodland affected by the Proposed Scheme.

2.6.10 Option E would provide the most flexibility for train routeing, but it would have the largest requirement for land and would cause the most disruption to WCML services and highest cost of all options.

2.6.11 Therefore Option C, with HS2 connecting to the inner (fast) tracks of the WCML and only the eastern WCML tracks being realigned, was taken forward for further development within the Proposed Scheme for the connection to the WCML at Handsacre.

Curdworth to Lichfield alignment

Provision of grade separated spur for Phase Two western leg to Manchester (Manchester spur)

2.6.12 The connection from London and Birmingham to Manchester and the North West requires a crossing over or under the HS2 main line to provide the required junction capacity and journey times. The January 2012 announced route for Phase One did not include details of the junction to Manchester. Phase Two work has developed the alignment for the Manchester spur.

2.6.13 The location is constrained by the line to the WCML at Handsacre, the proposed line of the Manchester spur, Fradley Park, the Trent and Mersey Canal and the grade separated A38 Streethay junction.

2.6.14 The following options were considered for the horizontal alignment:

- Option A – The January 2012 announced route. This design would not include a fully coordinated grade separated junction for Phase Two to Manchester. This option was developed with a junction at Handsacre connecting to the central lines of the WCML;
- Option H – This option would provide a grade separated junction for Manchester as close as possible to the January 2012 announced route. The design would require two separate embankments for the tracks between the Phase Two Junction and the connection to the WCML; and
- Option L – This option would provide a grade separated junction for Manchester using a single embankment on the link to the WCML and would require that the horizontal alignment was moved away from the January 2012 announced scheme by a maximum of about 200m.

2.6.15 Option A would not provide a fully coordinated grade separated junction and was therefore discounted.

2.6.16 Option H would result in increased environmental impacts due to the increased width of the construction corridor for the twin embankments.

2.6.17 Option L would provide the required grade separated junction and would have less environmental impact than Option H.

2.6.18 Option L, using a single embankment on the link to the WCML would have a lower capital cost and less of an impact on woodland and heritage conservation areas than the other options. Therefore, Option L was taken forward for further development within the Proposed Scheme for the grade separated junction for Manchester (Phase Two).

Options to increase speed

2.6.19 The January 2012 announced scheme included approximately 12km of alignment with a running speed of 350kph. An opportunity was identified to reduce journey times between London and Manchester by increasing the running speed in this section. Other potential benefits were investigated within these options including reducing the impact on businesses throughout the affected section.

2.6.20 A number of alternatives were considered by varying the horizontal alignment between the M42 crossing south of Middleton and the connection to the WCML. None of these options has been taken forward, on the basis of their provision of only marginal benefits in terms of speed gain against increased environmental and stakeholder/community impact and increased financial cost.

Options to mitigate Fradley business park impact

2.6.21 The aim of this options assessment was to reduce the environmental impacts and socio-economic effects on the existing and proposed commercial developments at

Fradley Park. This family of options preserved the original January 2012 announced route until the Proposed Scheme passes Rookery Lane at Hints, and varies thereafter:

- Option F – This option would realign the route away from Fradley Park, moving the alignment towards Streethay and would require a raised crossing over the A38 and the demolition of Streethay Manor;
- Option G – This option would maintain the position of the crossing of the A38 but would continue to curve away from Fradley Park. This option would require a twin embankment between the junction for Phase Two and the WCML;
- Option M – Similar to Option G, with a modification to the alignment between the junction to the Manchester spur and Handsacre Junction to use a single embankment, in combination with a reduction in running speed for the link between the HS2 main line and the WCML; and
- Option N – A realignment that would avoid the Fradley Park existing and proposed developments while maintaining the location of the crossing of the A38 at the low point. This would also require an eastward realignment of the route south of the A38.

2.6.22 Options F and G, which mitigate the business impacts at Fradley Park, were discounted due to their adverse impacts on Streethay community and the listed buildings and scheduled monument at Streethay Manor.

2.6.23 Option N was discounted due to impacts and stakeholder concerns south of the A38.

2.6.24 Option M was subsequently compared against Option L. Option M provides reduced impacts on woodland, listed structures and jobs compared to Option L and would be less expensive. These benefits outweighed the reduction in line speed on the link between HS2 and the WCML. Therefore, Option M, which maintains the position of the crossing of the A38 but would continue to curve away from the Fradley Park with the alignment between the junction to the Manchester spur and Handsacre Junction being modified to use a single embankment, in combination with a reduction in running speed for the link between the HS2 main line and the WCML, was taken forward for further development within the Proposed Scheme for the alignment between Curdworth and Lichfield.

Arrangement of junction for Phase Two western leg to Manchester

2.6.25 The output from the route optioneering process described above resulted in Option M, being taken forward for the development of the grade separated junction work for Manchester. This option maintains the January 2012 announced route alignment for the crossing of the A38 but would continue to curve away from the Fradley Park. The alignment between the junction to Manchester and Handsacre Junction was modified to use a single embankment, in combination with a reduction in running speed for the link between the HS2 main line and the WCML.

2.6.26 The following sub-options were considered for the vertical profile of the junction:

- Sub-option (i) – Handsacre link over HS2 main line to Manchester. For this option the main line to Manchester would be lowered as much as practical to achieve minimum clearance over the Trent and Mersey Canal; and

- Sub-option (ii) – Handsacre link under the HS2 main line to Manchester. The line from Handsacre would be lowered as much as practicable to achieve minimum clearance over the Trent and Mersey Canal. The main line to Manchester would be raised to pass over the link to Handsacre at a higher alignment.

2.6.27 Sub-option (i) would be less expensive and would provide environmental benefits over Sub option (ii) due to the reduced height of the high speed lines and was, therefore, taken forward for further development within the Proposed Scheme for the grade separated junction for Manchester (Phase Two).

Community forum proposals south of the junction for Manchester

2.6.28 Five community proposals comprising long bored tunnels as well as tunnels or bridges under the A38 and WCML were assessed. These options were developed in combination with the options to mitigate Fradley Business Park Impact:

- Option I – This option would include a green tunnel from the A51 through Whittington Heath Golf Club, followed by a bored tunnel beneath the WCML, South Staffordshire Railway Line and the A38 dual carriageway before resurfacing to provide the junction for Phase Two to Manchester;
- Option J, K & O – This family of options would pass beneath the WCML, South Staffordshire Railway Line and A38 using overbridges and cuttings. Each option followed a different horizontal alignment; and
- Option P – This option considered the shortest bored tunnel viable under the WCML, South Staffordshire Railway Line and A38. This was similar to Option I but with the green tunnel approaches removed.

2.6.29 Option I would provide substantial environmental benefits and would reduce the potential disruption to the existing roads and railways crossed by the route. However, this is outweighed by the very high cost of providing a tunnel.

2.6.30 Options J, K and O would provide a significant proportion of the benefits associated with Option I, but at a significantly reduced cost. The horizontal alignment of Option O would have the least environmental impact and cost of these options.

2.6.31 Although Option P would offer reduced costs over Option I it would remain significantly more expensive than Option O.

2.6.32 The most cost effective lowered option is Option O. This would mitigate much of the visual and noise impacts during operation. Option O was compared against Option M in greater detail. Although both options would require a level of disruption to the existing transport infrastructure, investigation into the nature of the geology and hydrology indicated that it would be difficult to construct the crossings of the A38, South Staffordshire Railway Line and WCML for Option O. The construction of Option O would lead to an unacceptable level of disruption to these important railways and highway. Whilst the lowered options provide an overall reduction in environmental impacts, they would come with significant disruption to existing transport infrastructure and with increased construction costs.

2.6.33 Therefore, none of these options have been taken forward.

Extent of the spur for the Manchester spur

2.6.34 It would be very expensive and disruptive to make connections for Phase Two to the HS2 Phase One route after the railway becomes operational because the works would have to be undertaken in a combination of short night time periods and more extensive line closures. An interface point between the two phases was therefore investigated along the spur to Manchester.

2.6.35 The general principle behind the interface point was for it to be located in order to enable Phase Two to be constructed without adversely affecting the operation of Phase One.

2.6.36 In addition to the grade separated bridge and lines through the junction, the junction spur will comprise an elevated railway which will extend to a point around 150 metres north of the Trent and Mersey Canal crossing. Around 200 metres of embankment will be built between the Phase One line and the canal, because access to this area for construction will be difficult near the operational Phase One railway. The canal crossing will also be constructed, as the Phase One main line already involves two crossings of the canal nearby and it will avoid repeated disruption if the third crossing in the area for Phase Two is completed at the same time. Finally around a further 150 metres of the route will be constructed north of the canal to avoid repeated impacts to adjacent woodlands by both HS2 Phase One and Two.

2.6.37 Therefore, an interface point for the junction for the Manchester spur, which will extend to a point around 150 metres north of the Trent and Mersey Canal crossing, has been taken forward for further development within the Proposed Scheme for the grade separated spur for Manchester (Phase Two).

Community Proposals North of the A38

2.6.38 Several proposals were put forward by community groups to amend the design north of the A38. These alternatives were assessed against the Proposed Scheme which was referred to as option A.

2.6.39 Option B considered a realignment of the Trent and Mersey Canal to the north of HS2. This would remove a constraint to the design of the vertical alignment that would have enabled the link between the mainline and Handsacre to be lowered.

2.6.40 Option C also considered a realignment of the Trent and Mersey Canal; however, the arrangement of the spur to Manchester included the link to Handsacre passing over the mainline to Manchester.

2.6.41 The two options B and C would have provided some localised environmental benefits, but would also have negative impacts on the ecology, heritage and setting of the canal and its associated listed structures, conservation area and local wildlife site. These options would not have had the support of key affected stakeholders. As no overall benefit was identified and as the canal realignment was likely to be opposed, the options were not taken forward.

2.6.42 An alternative that placed the alignment in a bored tunnel under the Trent and Mersey canal (option D) would have required the alignment to be lowered to approximately 20m below the lowest ground level (a rail level of approximately 45m AOD, 30m lower than existing). To achieve this, both the Handsacre link and the Manchester mainline

would need to pass under the canal in tunnels. Due to the limited benefits that this proposal would provide, the significant realignment required and the additional cost, the option was not taken forward.

2.6.43 Option E considered a realignment of the Handsacre link to avoid a double crossing of the Trent and Mersey Canal. Although an alignment could have been developed, other constraints would mean the speed of the link would reduce to 170kph and would still pass close to the canal. As this alignment did not meet the original proposal to avoid impacts on the canal from the Handsacre link and required a speed reduction that was assessed to have a significant impact on the potential operation of HS2, the option was not taken forward.

3 Agriculture, forestry and soils

3.1 Introduction

3.1.1 This section provides a description of the current baseline for agriculture, forestry and soils and an assessment of the likely impacts and significant effects as a result of the construction and operation of the Proposed Scheme. 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.

3.1.2 The quality of agricultural land in England and Wales is assessed according to the Agricultural Land Classification (ALC) system, which classifies agricultural land into five grades from excellent quality Grade 1 land to very poor quality Grade 5 land. Grade 3 is subdivided into Subgrades 3a and 3b. The main issue in the assessment of the impacts on agricultural land is the extent to which land of best and most versatile (BMV) agricultural quality (Grades 1, 2 and 3a) is affected by the Proposed Scheme.

3.1.3 Forestry is considered as a land use feature and the impacts have been calculated quantitatively. The qualitative effects on forestry land and woodland are addressed principally in the ecology and landscape and visual assessments (see Sections 7 and 9).

3.1.4 Soil attributes, other than for food and biomass production, are identified in this section but the resulting function or service provided is assessed in other sections, notably cultural heritage, ecology and landscape and visual assessments (see Sections 6, 7 and 9).

3.1.5 The main issue for farm holdings is the disruption by the Proposed Scheme of the physical structure of agricultural holdings and the operations taking place upon them, during both its construction and operational phases. Engagement has been undertaken with farmers and landowners affected by the Proposed Scheme to obtain factual information on the scale and nature of the farm and forestry operations and related farm-based uses.

3.1.6 Details of published and publicly available information used in the assessment, and the results of surveys undertaken within the Whittington to Handsacre area, are contained in Volume 5: Appendix AG-001-022.

3.2 Scope, assumptions and limitations

3.2.1 The assessment scope, key assumptions and limitations for the agriculture, forestry and soils assessment are set out in Volume 1, the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

3.2.2 The study area for the agriculture, forestry and soils assessment covers all of the land that will be required for the construction and operation of the Proposed Scheme. The resources and receptors that are assessed within this area are agricultural land, forestry land and soils; together with farm and rural holdings. The assessments of the

impacts on agricultural land quality and forestry land are made with reference to the prevalence of BMV land and forestry in the general locality, taken as 2km either side of the centre line of the Proposed Scheme.

3.2.3 Common assumptions that have been applied to the Proposed Scheme, such as the restoration of agricultural land to pre-existing quality, the handing back of land used temporarily to the original landowner and the non-replacement of capital items demolished, are set out in Volume 1.

3.3 Environmental baseline

Existing baseline

3.3.1 This section sets out the main baseline features that influence the agricultural and forestry use of land within the Whittington to Handsacre area. These include the underlying soil resources which 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.

Soils and land resources

Topography and drainage

3.3.2 The main topographical features within the study area are described in detail in the landscape and visual assessment (Section 9). The proposed route through this area extends northwards from the A51 Tamworth Road at Whittington Heath over dissected sandstone country, falling from 100m above Ordnance Datum (AOD) on the Whittington Heath Golf Club to 65m AOD on the floodplain near Huddlesford. From there, the route proceeds north-westwards across lowlands at 65m to 75m AOD before rising slightly west of Bourne Brook.

3.3.3 Drainage is served by north-east flowing brooks at Huddlesford and branches of the Mare Brook around Streethay which are tributaries of the River Tame. Further west, the Curborough and Bourne Brooks, fed by numerous smaller brooks and drains, flow towards the River Trent to the north of Handsacre.

Geology and soil parent materials

3.3.4 The main geological features are described in detail in Land quality (Section 8) and summarised in Volume 5: Appendix AG-001-022.

3.3.5 Superficial deposits intermittently underlie the Proposed Scheme. The Proposed Scheme will pass through the following:

- River Terrace Deposits (sands and gravels) surround a surface watercourse to the south-west of Fradley Park;
- Glaciofluvial Sheet Deposits (comprising sand and gravel with lenses of clay, silt and organic material) underlie the Proposed Scheme almost continuously from Gorse Farm at Fradley to the northern end of the study area;
- narrow strips of alluvium (comprising clay, silt, sand and gravel) are present around the channel of an unnamed brook located between Mill Farm and the Wyrley and Essington Canal and also around Pyford Brook situated to the north-west of Fradley Park; and

- Head Deposits, variably comprising clay, silt, sand and gravel resulting from downslope movement, are present to the north of Streethay.

3.3.6 Bedrock of the Triassic period underlies the whole of the Proposed Scheme in the study area. The Sherwood Sandstone Group, (comprising the Bromsgrove Sandstone Formation and Kidderminster Formation) features pebbly, gravelly sandstone, and is present from the southern end of the study area as far north as Hill Farm at Streethay. The Mercia Mudstone Group, described as red and green-grey, mudstones and subordinate siltstones with widespread thin beds of gypsum/anhydrite, underlies the Proposed Scheme from Hill Farm at Streethay to the northern end of the study area.

Description and distribution of soil types

3.3.7 The characteristics of the soils are described by the Soil Survey of England and Wales[5] and shown on the National Soil Map[6]. More detailed published information is also available for part of the area[7]. The soils are grouped into associations of a range of soil types. They are described in more detail in Volume 5 and their distribution is shown on Map AG-02-022 (Volume 5, Agriculture, forestry and soils Map Book). The soils throughout this area are variable according to the topography and geology.

3.3.8 The Bromsgrove association is mapped on part of the Bromsgrove Sandstone Formation between Darnford Lane, Whittington and the A38 at Streethay. The dominant soil type is a free draining, reddish sandy loam topsoil over sandstone, at depth in places, i.e. Wetness Class[8] (WC) I. There are some sandy loams with slowly permeable subsoils of siltstone and sandstone that experience slight seasonal waterlogging (WC II).

3.3.9 The Bridgnorth association has well drained (WC I), sandy loam and loamy sand soils over soft sandstone, at depth in some places. It occurs in the south of the area on Whittington Heath on the Kidderminster Formation.

3.3.10 Deep sandy loam and loamy sand soils of the Newport 1 association occur in glacial river sand and gravel deposits at the north-western end of the study area from Bourne Brook to Handsacre. The soils are described as well drained (WC I), but a soil survey for the Proposed Scheme shows that there are some soils with slowly permeable clay and clay loam layers in the subsoil that cause seasonal waterlogging (WC II).

3.3.11 Small parts of the area cross soils of the similar Brockhurst 1 and Clifton associations; the former developed on mudstones with thin superficial drift west of Huddlesford and the latter west of Hilliard's Cross in deep reddish light and medium loamy drift. Topsoils and upper subsoils tend to be medium clay loams or medium silty clay loams, but the slowly permeable clay or clay loam lower subsoils cause most soils to be seasonally waterlogged (WC III to IV).

[5] Soil Survey of England and Wales (1984), Soils and their Use in Midland and Western England, Bulletin 12.
[6] Cranfield University (2001), The National Soil Map of England and Wales 1:250,000 scale, National Soil Resources Institute, Cranfield University, UK.
[7] Hollis, John (2001), Soils in Staffordshire IV Sheet SK00/10 (Lichfield); Rothamsted Experimental Station.
[8] The Wetness Class (WC) of a soil is classified in Appendix II of Hodgson, J.M. (1977), The Soil Survey Field Handbook. Soil Survey and Land Research Centre, Technical Monograph No.5, according to the depth and duration of waterlogging in the soil profile and has six bands ranging from Wetness Class I (well drained) to Wetness Class VI (permanently waterlogged).

3.3.12 On the low ground between Fradley and Bourne Brook, there are deep permeable sandy loams over loamy sands and sands of the Blackwood association. In their natural state these soils have high groundwater levels, but these are now largely controlled by ditches (WC II to III).

3.3.13 Soils on the river terrace deposits in the Mare Brook catchment north and east of Streethay include deep permeable sandy loams over loamy sands and sands of the Wigton Moor association. They are variably affected by groundwater (WC I to III)

3.3.14 Narrow strips of alluvial soils beside the brooks are too small in extent to be distinguished on the published soil maps.

Soil and land use interactions

Agricultural land quality

3.3.15 The principal soil/land use interaction in the study area is the quality of the agricultural land resource. The Agricultural Land Classification (ALC)[9] is based on the identification of physical limitations to the agricultural capability of land resulting from the interactions of soil, climate and the site.

3.3.16 The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. There are three distinct soil characteristics within the Whittington to Handsacre area. The main soil characteristics are sandy loams over loamy sands and sands, in some places stony, over sandstone of the Kidderminster and Bromsgrove Sandstone Formations (Bromsgrove, Bridgnorth and Newport 1 associations). Soil depth is a limitation where hard sandstone occurs at shallow depths. Poor soil structure occurs in slowly permeable subsoils that have developed on mudstones (Brockhurst 1 and Clifton associations). Finally, there are fluctuating groundwater levels in permeable soils in valleys and the extensive, low-lying spread of glaciofluvial deposits (Blackwood and Wigton Moor associations).

3.3.17 Climate in this part of England does not in itself place any limitation upon land quality but the interactions of climate with soil characteristics are important in determining the wetness and droughtiness limitations of the land. The influence of climate on soil wetness is assessed by reference to median field capacity days (FCD) when the soil moisture deficit is zero, soil WC and topsoil texture. Droughtiness is determined by comparing the available water capacity of the soil, adjusted for the crop, with the moisture deficit for the locality for two crops; winter wheat and potatoes.

3.3.18 The local climatic factors have been interpolated from the Meteorological Office's standard 5km grid point dataset at two points within the community forum area, set out in Appendix 5: Appendix AG-001-022. FCDs range from 154 to 166 days, which is slightly above the average for lowland England (150 days). This is considered to be quite favourable for providing opportunities for agricultural cultivations and soil handling.

[9] 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.

3.3.19 The assessment of site factors is primarily concerned with the way in which topography influences the use of agricultural machinery and, hence, the cropping potential of land. Gradient and micro relief, with complex changes of slope angle or direction over short distances, are not considered limiting in the study area. Flooding may occur on some narrow floodplains of brooks (such the Bourne Brook) but the very small extent and limited frequency means it is not significant in terms of ALC.

3.3.20 The principal limiting factors determining agricultural land quality in this area are soil wetness and soil droughtiness. Overall, the assessment of agricultural land required for constructing and operating the Proposed Scheme indicates that almost 89% is in the best and most versatile (BMV) category, predominantly in Subgrade 3a (59%) with a smaller proportion of Grade 2 (30%). Grade 2 mainly occurs south of Streethay and south-east of Handsacre on sandy loam soils of the Bromsgrove and drained parts of the Blackwood associations.

3.3.21 The remaining 11% of agricultural land is lower quality Subgrade 3b, found on the heavier, more clayey land (Clifton and Brockhurst 1 associations) west of Huddlesford and Hilliard's Cross. Full details of the ALC are provided in Volume 5: Appendix AG-001-022, and the ALC grading is shown on Map AG-01-061b to AG-01-065 (Volume 5).

3.3.22 Department for Environment, Food and Rural Affairs (Defra) mapping[10] shows that there is generally a high likelihood of encountering BMV land in the locality, which makes such land a resource of low sensitivity in this area.

Other soil interactions

3.3.23 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[11] and The Natural Choice: securing the value of nature[12], and include:

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

3.3.24 Forestry resources represent a potentially multifunctional source of productive timber, landscape amenity, biodiversity and carbon storage capacity. The value and sensitivity of the resources are assessed in Section 7, Ecology.

3.3.25 The Environment Agency Flood Zone mapping (Environment Agency website, 2012) indicates four main areas within the land required for construction or operation of the

[10] Defra (2005), *Likelihood of Best and Most Versatile Agricultural Land.*
[11] Defra (2009), *Soil Strategy for England.*
[12] Defra (2011), *The Natural Choice: securing the value of nature.*

Proposed Scheme to be at risk from river flooding. These are associated with the River Tame, Mare Brook, Curborough Brook and a tributary of Bourne Brook, as set out in Section 13, Water resources and flood risk assessment. Flood Zone mapping shows there to be a risk of flooding in this area, with the soils functioning as water stores for flood attenuation, as well providing a habitat for ecology.

3.3.26 The presence of soil-borne cultural assets is detailed in Section 6, Cultural heritage.

Land use

Land use description

3.3.27 Agricultural land use is a mixture of combinable arable and grassland, but dominated by arable. The principal arable crop is wheat and there is one fruit-growing enterprise. Livestock include sheep, beef and dairy cattle.

3.3.28 A number of environmental designations potentially influence land use within the study area. The whole area is a nitrate vulnerable zone (NVZ), which is an area in which nitrate pollution is a potential problem. Statutory land management measures apply which seek to reduce nitrogen losses from agricultural sources to water. Some agricultural land is also subject to management prescriptions associated with the Environmental Stewardship Scheme which seeks either generally (the Entry Level Scheme) or specifically (the Higher Level Scheme) to retain and enhance the landscape and biodiversity qualities and features of farm land. Holdings which have land entered into an agri-environment scheme are identified in Table 9.

3.3.29 Stands of woodland include Fulfen Wood in the south, Lyntus Wood just north of Curborough, and Brokendown Wood and Ravenshaw Woods in the north. Woodland is often situated on low ground affected by high groundwater (Blackwood association). Woodland covers 5% of land in occasional stands of small woods within the study area, compared to the national average of 10%. Therefore, the sensitivity of the forestry land resource is high.

Number, type and size of holdings

3.3.30 There are 36 holdings in the study area, as set out in Table 9. The boundaries of the holdings are shown on Maps AG-01-061B to AG-01-065 (Volume 5) along with the location of the main farm buildings. Ten are mixed arable and livestock,eight are mainly arable and two are given over to general cropping. There are two equestrian-based holdings, one of which is operated on a commercial basis. Seven holdings are woodland and three are given over to grassland. For the remainder, there is one each of dairy, sheep, cattle and commercial fruit growing (with irrigation and polytunnels). The holdings range in size from 1.9ha to 1619ha. The larger farms are either mixed arable with livestock, or mainly arable. The smallest holding is permanent grassland. The seven woodlands vary between 2.5ha and 43ha.

3.3.31 Table 9 sets out the sensitivity of individual holdings to change, which 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) and irrigation systems are less able to accommodate change and have a higher sensitivity. Smaller (less intensively used)

units, such as pony paddocks associated with residential properties, have a low sensitivity.

Table 9: Summary of characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA22/1 Fulfen Farm	Mainly arable	71.6	Golf course	ELS	Medium
CFA22/2* Land off Cappers Lane	Mixed arable and livestock	30.6	Equestrian (commercial)	ELS	Medium
CFA22/3 Huddlesford House Farm	Mixed arable and livestock (including dairy)	323.8	None	ELS	High Dairy
CFA22/4 Hill Farm Streethay	Mixed arable and livestock	28.3	Residential lets	ELS	Medium
CFA22/5* Streethay Farm	Mixed arable and livestock	32.5	Equestrian (commercial); Airfield; Commercial and industrial building lets in the farm complex	ELS	Medium
CFA22/6* Streethay House Farm	Mainly arable	91.7	Not known	None	Medium
CFA22/7* Curborough House Farm	Mainly arable	172.0	Equestrian (commercial); storage; sporting: car sprint course; sporting: model airplane club	None	Medium
CFA22/8 Curborough Farm	Mixed arable and livestock (sheep and cattle)	272.0	Tea rooms; craft centre; sporting: fishing lakes (100 pegs); 27 non-agricultural business lets	ELS	High Irrigation
CFA22/9 Big Lyntus Wood	Woodland	6.7	Not known	None	Medium
CFA22/10 Land around Fradley Wood	Mixed arable and livestock	1618.8	Residential let	ELS	High Irrigation
CFA22/11 Riley Hill Woodend Farm	Mainly arable	60.0	Residential let	ELS	High Irrigation
CFA22/12 Ravenshaw Wood (East)	Woodland	15.0	None	None	Low
CFA22/13 Black Slough Farm	Mainly livestock (dairy)	56.0	None	ELS	High Dairy
CFA22/14 Ravenshaw Wood (West)	Woodland	12.0	None	None	Low
CFA22/15 Hauchwood	Mixed arable and livestock	121.4	Commercial shoot	ELS and HLS	High Irrigation
CFA22/16	Mixed arable and	283.3	None	ELS	High

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
Brownfields Farm	livestock				Irrigation
CFA22/17 Hunts Farm	Mixed arable and livestock	32.4	None	ELS and HLS	Medium
CFA22/18 New Farm, Elmhurst	Horticulture – fruit grower	33.1	Processing and packing facility	ELS	High Horticulture
CFA22/19 Ashton Hayes Farm	Mixed arable and livestock	16.2	None	ELS	Medium
CFA22/20 Tuppenhurst Field	General cropping (cereals and potatoes)	6.9	None	ELS	Medium
CFA22/21 Tuppenhurst Farm	Mainly arable	303.5	Agricultural contracting	ELS	Medium
CFA22/24* Brokendown Wood	Woodland	4.0	Not known	None	Medium
CFA22/25* Thatchmore Farm	Mainly arable	71.7	Not known	ELS	Medium
CFA22/26* Land south of Thatchmore Farm A	Equestrian (commercial)	3.5	Not known	ELS	Medium
CFA22/27* Land on NE side of Marsh Lane	Mainly livestock (Sheep)	1.9	Not known	None	Medium
CFA22/28 Whittington Hill Farm	Equestrian (non-commercial)	4.5	None	None	Low
CFA22/29 Vicar's Coppice	Woodland	7.7	Sporting: paint-balling	None	Low
CFA22/30 Fradley Wood	Woodland	43.5	None	Woodland Grant, ELS	Low
CFA22/31* Land adjacent to Fulfen Farm	Grassland	3.4	Not known	ELS	Medium
CFA22/32* Woodland adjacent to Easthill House	Woodland	2.5	Not known	None	Medium
CFA22/33* Land south of Thatchmore Farm B	Grassland	7.4	Not known	None	Medium
CFA22/34* Land off Broad Lane	Mixed arable and livestock	7.6	Not known	None	Medium
CFA22/35* Bearshay Farm	Mainly arable and some grassland	61.0	Not known	None identified	Medium
CFA22-36 Land adjacent to Rileyhill Farm*	General cropping (cereals and potatoes)	23.1	Not Known	None identified	Medium

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA22-37 Land on the south side of Darnford Lane*	Grassland	2.6	Not known	ELS	Medium
CFA22-38 Land lying to the North of Tamworth Road*	Mainly livestock (suckler cows)	9.1	Not Known	None identified	Medium

* No farm impact assessment interview conducted; data estimated.

Future baseline

Construction (2017)

3.3.32 No committed developments have been identified in this area that will materially alter the baseline conditions in 2017 for agriculture, forestry and soils.

3.3.33 The future of agri-environment schemes is uncertain at present due to on-going reform of the Common Agricultural Policy. The majority of schemes seem likely to cease over the next two to three years and replacements are uncertain. Whilst this will remove a level of support from the agricultural industry that has been used to offset some of the costs incurred in managing land in an environmentally responsible manner, it is unlikely to materially alter the way agricultural land is managed in the future. Whilst some field margins may be cropped closer to hedgerows and stocking rates may increase in some locations, the stocking and cropping baseline set out in the previous section is unlikely to change significantly.

Operation (2026)

3.3.34 No committed developments have been identified in the Whittington to Handsacre area that will materially alter the baseline conditions in 2026 for agriculture, forestry and soils.

3.4 Effects arising during construction

Avoidance and mitigation measures

3.4.1 During the development of the design, the following measures have been incorporated to avoid or mitigate impacts on agriculture, forestry or soils during construction. Access across the HS2 alignment for agricultural vehicles will be provided by:

- overbridge at Darnford Lane;
- underbridges at Lichfield Road, Broad Lane, Wood End Lane and the A515 Lichfield Road; and
- viaducts at Cappers Lane, Fulfen Wood, Streethay, Bourne Brook and Trent and Mersey Canal East and West.

3.4.2 In addition, there is a need to avoid or reduce environmental impacts to soils during construction. It is an essential element of the construction process that the soil resources from the areas required temporarily and permanently are stripped and

stored so that land required temporarily for construction purposes which is currently in agricultural use can be returned to that use, where agreed, and to its pre-existing agricultural condition.

3.4.3 Subject to the adoption of good practice techniques in handling, storing and reinstating soils on land where agricultural or forestry uses are to be resumed, there will be no reduction in the long term capability which would downgrade the quality of disturbed land. Some land with heavier textured soils may require careful management during the aftercare period to ensure this outcome.

3.4.4 Compliance with the CoCP will avoid or reduce environmental impacts during construction. Of particular relevance to agriculture, forestry and soils are the following measures (see Volume 5: Appendix CT-003-000/1):

- the reinstatement of agricultural land which is used temporarily during construction to agriculture, where this is the agreed end use (draft CoCP, 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 (draft CoCP, Section 6);
- a requirement for contractors to monitor and manage flood risk and other extreme weather events which may affect agriculture, forestry and soil resources during construction (draft CoCP, Section 16);
- arrangements for the maintenance of farm and field accesses affected by construction (draft CoCP, Section 6);
- the protection and maintenance of existing land drainage and livestock water supply systems, where reasonably practicable (draft CoCP, Sections 6 and 16);
- the protection of agricultural land adjacent to the construction site, including the provision and maintenance of appropriate stock-proof fencing (draft CoCP, Sections 6 and 9);
- the adoption of measures to control the deposition of dust on adjacent agricultural crops (draft CoCP, 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 (draft CoCP, Section 9);
- the adoption of measures to prevent, as far as reasonably practicable, the spread of soil-borne, crop and animal diseases from the construction area (draft CoCP, Sections 6 and 9); and
- liaison and advisory arrangements with affected landowners, occupiers and agents, as appropriate (draft CoCP, Sections 5 and 6).

Assessment of impacts and effects

3.4.5 The cessation of existing land uses will be required, not only the land on which permanent works will be sited, but also on the land used temporarily to facilitate the construction of those permanent works.

3.4.6 All of the land required for the Proposed Scheme for its construction will, in places, sever and fragment individual fields and operational units of agricultural and forestry land. This will result in potential effects associated with the ability of affected agricultural interests to continue to access and effectively use residual parcels of land. There may also be loss of, or disruption to, buildings and operational infrastructure such as drainage. The scheme design seeks, however, to minimise this structural disruption, and to incorporate inaccessible severed land as part of environmental mitigation works. Structural disruption is disruption to the existing structure of farm holdings principally from severance and the loss of key farm infrastructure.

3.4.7 The timing and duration of various construction elements are set out in Section 2.3. Where land is restored to agricultural use, it will be subject to a further five years of managed aftercare to ensure stabilisation of the soil structure, where appropriate.

3.4.8 Land used for the construction of the Proposed Scheme will fall into a number of categories when work is complete, as follows:

- part of the operational railway and kept under the control of the operator;
- returned to agricultural use (with restoration management);
- used for drainage or flood compensation which may also retain some agricultural use; or
- used for ecological mitigation.

Temporary effects during construction

Impacts on agricultural land

3.4.9 During the construction phase, the total area of agricultural land used will be 326.6ha as shown in Table 10. Of this total, 161.6ha will be restored and available for agricultural use following construction.

Table 10: 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%	0.0
Grade 2	96.5	30%	53.4
Subgrade 3a	194.1	59%	99.9
BMV SUBTOTAL	290.6	89%	153.3
Subgrade 3b	36.0	11%	8.3
Grade 4	0.0	0%	0.0
Grade 5	0.0	0%	0.0
TOTAL AGRICULTURAL LAND	326.6	100%	161.6

3.4.10 The disturbance during construction to 290.6ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% of the overall agricultural land requirement. Considering BMV land in this local area is a receptor of low sensitivity, the effect on BMV land is assessed as a moderate adverse effect of the Proposed Scheme, which is significant.

3.4.11 Following completion of construction, all temporary facilities will be removed and the topsoil and subsoil will be reinstated in accordance with the agreed end use for the land. Overall, it is estimated that there will not be any significant surplus of topsoil or subsoil material arising from the Proposed Scheme in the area.

Nature of the soil to be disturbed

3.4.12 The sensitivity of the soils is greatest in relation to those which will be disturbed by construction activity and returned to an agricultural or other rural land-based use upon completion of the Proposed Scheme. The quantum of each disturbed soil type is less important than the sensitivity of particular soils to the effects of handling during construction and reinstatement of land.

3.4.13 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[13]. These principles will be followed throughout the construction period. The heavier (clayey and silty) Brockhurst 1 association is least able to retain its structure when moved in wet conditions or by inappropriate equipment. They are susceptible to compaction and smearing and need careful handling to avoid damage to soil structure.

Impacts on holdings

3.4.14 Land may be required from holdings both permanently and temporarily (i.e. the latter just during the construction period). In most cases, the temporary and permanent land requirement 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. In due course some agricultural land will be restored and the impact on individual holdings will reduce, but the following assessment focuses on the combined effect during the construction phase. The residual permanent effects are described at the end of this section.

3.4.15 The effects of the Proposed Scheme on individual agricultural and related interests during the construction period are summarised in Table 11. This table shows the total area of land required on a particular holding in absolute terms and as a percentage of the total area farmed. It also shows the area of land that will 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. The holding/reference name provides a unique identifier and relates to map series AG-01 and Appendix AG-001-022, Volume 5.

3.4.16 The effects of severance during construction are judged on the ease and availability of access to severed land. For the most part these will be same during and post

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

construction but occasionally they will differ between the two phases. The disruptive effects, principally of construction noise and dust, are assessed according to their effects on land uses and enterprises. Full details of the nature and significance of effects are set out in Volume 5: Appendix AG-001-022. Where the total sum of the land required by ALC grade (Table 10) differs from the total sum of the land required by holding (Table 11), the difference is because some holdings are affected in more than one CFA and some holdings include non-agricultural land. The combined impact on holdings is reported once in the CFA where the main holding is located.

Table 11: Summary of temporary effects on holdings during construction

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA22/1 Fulfen Farm	22.0ha – 31% High	Low	Low	Major/Moderate Adverse	20.3ha
CFA22/2* Land off Cappers Lane	11.0ha – 36% High	Medium	Medium	Major/Moderate Adverse	1.8ha
CFA22/3 Huddlesford House Farm	31.6ha – 10% Low	Negligible	Low	Moderate Adverse	26.8ha
CFA22/4 Hill Farm Streethay	23.6ha – 83% High	Negligible	Low	Major/Moderate Adverse	17.2ha
CFA22/5* Streethay Farm	17.1ha – 53% High	Negligible	Medium	Major/Moderate Adverse	12.1ha
CFA22/6* Streethay House Farm	13.1ha – 14% Medium	Medium	Low	Moderate Adverse	0.3ha
CFA22/7* Curborough House Farm	29.8ha – 17% Medium	Medium	Low	Moderate Adverse	1.5ha
CFA22/8 Curborough Farm	28.9ha – 11% Medium	Negligible	Low	Major/Moderate Adverse	6.5ha
CFA22/9 Big Lyntus Wood	0.0ha – 1% Negligible	Negligible	Low	Minor Adverse	0.0ha
CFA22/10 Land around Fradley Wood	7.3ha – 1% Negligible	Negligible	Negligible	Minor Adverse	0.0ha
CFA22/11 Riley Hill Woodend Farm	7.3ha – 12% Medium	Negligible	Medium	Major/Moderate Adverse	0.2ha
CFA22/12 Ravenshaw Wood (East)	4.0ha – 27% High	Low	Low	Moderate Adverse	0.1ha
CFA22/13 Black Slough Farm	19.8ha – 35% High	Negligible	Low	Major Adverse	7.1ha
CFA22/14 Ravenshaw Wood (West)	3.6ha – 30% High	Low	Low	Moderate Adverse	0.7ha
CFA22/15 Hauchwood	16.5ha – 14% Medium	Medium	High	Major Adverse	4.9ha
CFA22/16 Brownfields Farm	21.3ha – 8% Low	Medium	Low	Major/Moderate Adverse	4.6ha

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA22/17 Hunts Farm	17.6ha – 54% High	Negligible	Low	Major/Moderate Adverse	13.4ha
CFA22/18 New Farm, Elmhurst	5.8ha – 17% Medium	Negligible	Medium	Major/Moderate Adverse	2.6ha
CFA22/19 Ashton Hayes Farm	4.5ha – 28% High	Negligible	Low	Major/Moderate Adverse	0.1ha
CFA22/20 Tuppenhurst Field	5.5ha – 79% High	Negligible	Low	Major/Moderate Adverse	0.5ha
CFA22/21 Tuppenhurst Farm	0.2ha – 0% Negligible	Negligible	Low	Minor Adverse	0.2ha
CFA22/24* Brokendown Wood	1.1ha – 28% High	Low	Low	Major/Moderate Adverse	0.0ha
CFA22/25* Thatchmore Farm	5.8ha – 8% Low	Negligible	Low	Minor Adverse	5.8ha
CFA22/26* Land south of Thatchmore Farm A	0.0ha – 0% Negligible	Negligible	Low	Minor Adverse	0.0ha
CFA22/27* Land on NE side of Marsh Lane	0.4ha – 20% High	Low	Low	Major/Moderate Adverse	0.0ha
CFA22/28 Whittington Hill Farm	2.6ha – 58% High	Negligible	Medium	Moderate Adverse	0.0ha
CFA22/29 Vicar's Coppice	0.4ha – 6% Low	Negligible	Low	Negligible	0.2ha
CFA22/30 Fradley Wood	1.6ha – 4% Negligible	Negligible	Low	Negligible	0.0ha
CFA22/31* Land adjacent to Fulfen Farm	0.0ha –< 1% Negligible	Negligible	Negligible	Negligible	0.0ha
CFA22/32* Woodland adjacent to Easthill House	1.3ha – 54% High	Negligible	Low	Major/Moderate Adverse	0.0ha
CFA22/33* Land south of Thatchmore Farm B	1.8ha – 24% High	Negligible	Low	Major/Moderate Adverse	1.8ha
CFA22/34* Land off Broad Lane	3.5ha – 47% High	Negligible	Low	Major/Moderate Adverse	3.5ha
CFA22/35* Bearshay Farm	7.7ha – 13% Medium	High	Low	Major/Moderate Adverse	7.7ha
CFA22-36 Land adjacent to Rileyhill Farm*	0.7ha – 3% Negligible	Low	Negligible	Minor Adverse	0.7ha
CFA22-37 Land on the south side of Darnford Lane*	1.8ha – 69% High	Low	Negligible	Major/Moderate Adverse#	1.8ha

Holding reference/name	Total area required	Construction severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA22-38 Land lying to the North of Tamworth Road*	3.1ha – 34% High	Low	Low	Major/Moderate Adverse#	3.1ha

* No farm impact assessment interview conducted; data estimated.
# land take and severance associated with a wayleave or similar and the scale of effect is a 'worst case'.

3.4.17 Overall, it is considered that 27 holdings will experience major or moderate temporary adverse effects during construction, which are significant. Of these, the temporary effects on two holdings (CFA22-37 and CFA22-38) area associated with land required for a wayleave, or similar, and the actual amount of land taken out of agricultural production temporarily is likely to be minimal and/or the effect will only be short term; therefore, the scale of effect is a 'worst case'. Most enterprises experiencing a major or moderate effect do so because a high proportion of the holding is required for construction. Severance and disruptive effects caused by construction activity results in major or moderate temporary adverse effects on the other holdings.

3.4.18 There are five farm enterprises which are potentially sensitive to noise or vibration emitted during the construction phase. At land off Cappers Lane (CFA22/2), Streethay Farm (CFA22/5) and Whittington Hill Farm (CFA22/28) horse paddocks or stables are close to construction. A construction track immediately adjacent to the farm residence at Riley Hill Woodend Farm (CFA22/11) is potentially disruptive. Dust generated by construction is potentially damaging to high value horticultural crops at New Farm Elmhurst (22/18). There are potential safety issues associated with commercial shoot activities at Haunchwood (22/15) which will require careful management during construction. Compliance with the draft CoCP will avoid or reduce such environmental impacts during construction.

Cumulative effects

3.4.19 No significant cumulative effects on agriculture, forestry and soils have been identified for the construction of the Proposed Scheme.

Permanent effects from construction

Impacts on agricultural and forestry land

3.4.20 Land used for the construction of the Proposed Scheme will fall into a number of categories when work is complete, as follows:

- part of the operational railway and kept under the control of the operator;
- returned to agricultural use (with restoration management);
- used for drainage or flood compensation which may also retain some agricultural use; or
- used for ecological and landscape mitigation.

3.4.21 Following construction and restoration, the area of agricultural land that will remain permanently required will be 164.9ha, as shown in Table 12.

Table 12: Agricultural and forestry land required permanently

Agricultural land quality	Total area required (ha)	Percentage of agricultural land
Grade 1	0.0	0%
Grade 2	43.1	26%
Subgrade 3a	94.2	57%
BMV SUBTOTAL	137.3	83%
Subgrade 3b	27.7	17%
Grade 4	0.0	0%
Grade 5	0.0	0%
TOTAL AGRICULTURAL LAND	165.0	100%
Forestry land	20.5	n/a

3.4.22 The permanent loss of 137.3ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% of the overall agricultural land requirement. As stated previously, BMV land in this area is a receptor of low sensitivity so that the permanent effect on BMV land is assessed as a major/moderate adverse effect of the Proposed Scheme, which is significant.

3.4.23 Areas proposed for ecological and landscape mitigation, which will be removed from mainstream agricultural production, include new planting for protected species near Mare Brook (CFA22/8 and CFA22/7), ponds to be included in a new planting area near the Trent and Mersey Canal (CFA22/10) and areas with potential for advance planting near Ravenshaw Woods (CFA22/12, CFA22/13 and CFA22/14).

3.4.24 There is no agricultural land engineered to provide additional flood compensation capacity in the Whitting to Handsacre area.

3.4.25 Areas of woodland that will be permanently affected include Fulfen Wood in the south, Lyntus Wood just north of Curborough, and Brokendown Wood and Ravenshaw Woods in the north. Overall, the total amount of forestry land required to implement the Proposed Scheme will be 20.5ha, out of the total permanent land area required for the operation of the Proposed Scheme of 216.1ha (9%). The extent of the forest cover in the study area is less than the average national woodland cover and so, quantitatively, the loss of this woodland is significant. The qualitative assessment of loss is addressed in other relevant sections.

Impacts on holdings

3.4.26 The permanent residual effects from the construction of the Proposed Scheme on individual agricultural and related interests is summarised in Table 13. The land required column refers to the area of land permanently required to operate the Proposed Scheme (in absolute terms and as a percentage of the overall area farmed). The degree of impact is based on the proportion of land required. The effects of severance are judged on the ease and availability of access to severed land once construction is completed and 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-001-022.

Table 13: Summary of permanent effects on holdings from construction

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA22/1 Fulfen Farm	1.8ha – 3% Negligible	Low	Negligible	Minor Adverse
CFA22/2* Land off Cappers Lane	9.1ha – 30% High	Medium	Negligible	Major/Moderate Adverse
CFA22/3 Huddlesford House Farm	4.8ha – 2% Negligible	Low	Negligible	Moderate Adverse
CFA22/4 Hill Farm Streethay	6.3ha – 22% High	High	High	Major/Moderate Adverse
CFA22/5* Streethay Farm	4.9ha – 15% Medium	Low	High	Major/Moderate Adverse
CFA22/6* Streethay House Farm	12.8ha – 14% Medium	Medium	Negligible	Moderate Adverse
CFA22/7* Curborough House Farm	28.3ha – 16% Medium	Medium	Low	Moderate Adverse
CFA22/8 Curborough Farm	22.4ha – 8% Low	Negligible	Negligible	Moderate Adverse
CFA22/9 Big Lyntus Wood	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA22/10 Land around Fradley Wood	7.3ha – 1% Negligible	Negligible	Negligible	Minor Adverse
CFA22/11 Riley Hill Woodend Farm	7.1ha – 12% Medium	Low	Negligible	Major/Moderate Adverse
CFA22/12 Ravenshaw Wood (East)	3.9ha – 26% High	Medium	Negligible	Moderate Adverse
CFA22/13 Black Slough Farm	12.7ha – 23% High	Negligible	Negligible	Major Adverse
CFA22/14 Ravenshaw Wood (West)	2.9ha – 24% High	Medium	Negligible	Moderate Adverse
CFA22/15 Hauchwood	11.6ha – 10% Low	Medium	Low	Major/Moderate Adverse
CFA22/16 Brownfields Farm	16.7ha – 6% Low	Medium	Low	Major/Moderate Adverse
CFA22/17 Hunts Farm	4.2ha – 13% Medium	Negligible	Low	Moderate Adverse
CFA22/18 New Farm, Elmhurst	3.2ha – 10% Low	Negligible	High	Major Adverse
CFA22/19 Ashton Hayes Farm	4.4ha – 27% High	Negligible	Low	Major/Moderate Adverse

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA22/20 Tuppenhurst Field	5.0ha – 72% High	Negligible	Low	Major/Moderate Adverse
CFA22/21 Tuppenhurst Farm	0.0ha – 0% Negligible	Negligible	Low	Minor Adverse
CFA22/24* Brokendown Wood	1.1ha – 28% High	Low	Negligible	Major/Moderate Adverse
CFA22/25* Thatchmore Farm	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA22/26* Land south of Thatchmore Farm A	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA22/27* Land on NE side of Marsh Lane	0.4ha – 20% High	Low	Negligible	Major/Moderate Adverse
CFA22/28 Whittington Hill Farm	2.6ha – 58% High	Negligible	Low	Moderate Adverse
CFA22/29 Vicar's Coppice	0.2ha – 3% Negligible	Negligible	Negligible	Negligible
CFA22/30 Fradley Wood	1.6ha – 4% Negligible	Negligible	Negligible	Negligible
CFA22/31* Land adjacent to Fulfen Farm	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA22/32* Woodland adjacent to Easthill House	1.3ha – 54% High	Negligible	Negligible	Major/Moderate Adverse
CFA22/33* Land south of Thatchmore Farm B	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA22/34* Land off Broad Lane	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA22-35 Bearshay Farm*	0.0ha – 0% Negligible	Negligible	Negligible	Negligible
CFA22/36 Land adjacent to Rileyhill Farm	0.0ha - 0% Negligible	Negligible	Negligible	Negligible
CFA22/35* Bearshay Farm	0.0ha - 0% Negligible	Negligible	Negligible	Negligible
CFA22/36* Land adjacent to Rileyhill Farm	0.0ha - 0% Negligible	Negligible	Negligible	Negligible

* No farm impact assessment interview conducted; data estimated.

3.4.27 Overall, it is likely that 23 holdings will experience major or moderate permanent adverse effects from the construction of the Proposed Scheme, which are significant. These effects principally result from a high proportion of the enterprise being required by the Proposed Scheme; although adverse effect is also triggered by severance impacts at two holdings (CFA22/15, Haunchwood and CFA22/16, Brownfields Farm) and loss of agricultural buildings (polytunnels) at CFA22/18, New Farm Elmhurst. Three holdings are rendered unviable (CFA22/4, Hill Farm Streethay; CFA22/5 Streethay Farm and CFA22/13 Black Slough Farm). Buildings will be demolished at Hill

Farm Streethay (CFA22/4), Streethay Farm (CFA22/5) and New Farm – Elmhurst (CFA22/18); at Hill Farm Streethay, these buildings include residential property.

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

Cumulative effects

3.4.29 No significant cumulative effects on agriculture, forestry and soils have been identified for the construction of the Proposed Scheme.

Other mitigation measures

3.4.30 Other mitigation measures that are proposed include specific access provisions at the following farm holdings: Ravenshaw Wood (East) (CFA22/12), Ravenshaw Wood (West) (CFA22/14), Haunchwood (CFA22/15), Brownfields Farm (CFA22/16), Hunts Farm (CFA22/17), Ashton Hayes Farm (CFA22/19), Tuppenhurst Farm (CFA22/21) and land on the north-east side of Marsh Lane (CFA22/27); measures to ensure retention of drainage functionality at the following farm holdings: CFA22/4, CFA22/16, CFA22/19 and CFA22/20 and provisions to secure irrigation water supplies at the following farm holdings: Huddlesford House Farm (CFA22/3), Haunchwood (CFA22/15) and Brownfields Farm (CFA22/16).

Summary of likely residual significant effects

3.4.31 Once the construction process is complete and land required temporarily has been restored, the residual permanent loss of agricultural land will be 165.0ha, of which 137.3ha is BMV. This is assessed as a moderate adverse residual effect which is significant.

3.4.32 A total of 23 holdings have been identified that will experience major or moderate permanent adverse effects, which are significant. Of these 18 are 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 to not significant, if chosen. Hill Farm Streethay (CFA22/4), Streethay Farm (CFA22/5) and Black Slough Farm (CFA22/13) will no longer be viable as agricultural enterprises in their current form. Buildings will be demolished at Hill Farm Streethay (CFA22/4), Streethay Farm (CFA22/5) and New Farm – Elmhurst (CFA22/18); at Hill Farm Streethay, these buildings include residential property.

3.5 Effects arising from operation

Avoidance and mitigation measures

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

Assessment of impacts and effects

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

- noise emanating from moving trains and warning signals; and

- the propensity of operational land to harbour noxious weeds.

3.5.3 The potential for significant effects on sensitive livestock receptors from noise has been assessed. No likely significant effects have been identified.

3.5.4 The propensity of linear transport infrastructure to harbour and spread noxious weeds is not only a consequence of the management of the highway and railway land, but also of the readiness of weed spread onto such land from adjoining land, which could be exacerbated with the effects of climate change. The presence of noxious weeds, ragwort in particular, will be controlled through the adoption of an appropriate management regime which identifies and remedies areas of weed growth which might threaten adjoining agricultural interests.

Summary of likely residual significant effects

3.5.5 No residual significant effects on agriculture, forestry and soils have been identified for the operation of the Proposed Scheme.

4 Air quality

4.1 Introduction

4.1.1 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, covering nitrogen dioxide (NO_2), fine particulate matter (PM10 and PM2.5)[14] and dust.

4.1.2 With regard to air quality, the main issues are anticipated to result from emissions of dust from the demolition, the construction of new structures and earthworks and possible transfer of dust and mud on to public highways from vehicles travelling to and from construction areas. In addition, there may be changes in concentrations of NO_2 and particulate matter due to changes in road traffic emissions during the construction and operation of the Proposed Scheme.

4.1.3 Detailed reports on the air quality data and assessments for this area, as well as relevant maps are contained within Volume 5. These include:

- Appendix AQ-001-022;
- Volume 5: Map Book – Air quality, Map AQ-01-022; and
- Volume 5: Map Book – Air quality, Map AQ-02-022.

4.1.4 Maps showing the location of the key environmental features can be found in the Volume 2: CFA22 Map Book.

4.2 Scope, assumptions and limitations

4.2.1 The assessment scope, key assumptions and limitations for the air quality assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1), the SMR Addendum (Volume 5: Appendix CT-001-000/2) and appendices presented in Volume 5: AQ-001-022.

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

4.2.3 The assessment of impacts arising from construction dust emissions has been undertaken using the methodology based on that produced by the Institute of Air Quality Management (IAQM)[15]. It is important to note that this methodology provides a means of assessing the scale and significance of effects that is partly dependent on the approximate number of receptors within close proximity to the dust-generating activities. In doing so, it assigns a lower scale of effect to cases where the number of properties is small, e.g. fewer than 10 properties. Thus, a single property cannot experience a 'significant effect' as defined by this methodology. The assessment

[14] 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 micrometres in diameter.
[15] Institute of Air Quality Management (2012), *Guidance on the assessment of the impacts of construction on air quality and the determination of their significance.*

presented here reaches a conclusion that incorporates this concept of significance being proportional to the number of people affected. However, in cases where less than 10 properties are within 20m of the construction activity, it will still be the case that mitigation in accordance with the CoCP will be applied.

4.2.4 The assessment of construction traffic impacts has used traffic data that is based on an estimate of the average daily flows in the peak month throughout the construction period (2017-2026). However, the assessment assumes 2017 vehicle emission rates and 2017 background pollutant concentrations. The reason for this is because both pollutant emissions from exhausts and background pollutant concentrations are expected to reduce year by year as a result of vehicle emission controls, and so the year 2017 represents the worst case for the assessment. Furthermore, it has been assumed that the changes in construction traffic would occur for the whole year. In many cases, this represents a pessimistic assumption as the duration of the proposed construction works may be much shorter.

4.3 Environmental baseline

Existing baseline

4.3.1 The environmental baseline reported in this section represents the environmental conditions identified within the study area. The main sources of existing air pollution in the Whittington to Handsacre area are road traffic emissions from the A38 trunk road, as well as the A51 Tamworth Road and A515 Lichfield Road.

4.3.2 Estimates for NO2, PM10 and PM2.5 concentrations have been obtained from UK-wide modelled pollution maps for 2012, published by the Department for Environment, Food and Rural Affairs (Defra)[16] in 2010. These data provide estimates of background concentrations of NO2, PM10 and PM2.5 for 1km grid squares across the UK.

4.3.3 The Whittington to Handsacre area lies within the West Midlands region, within the boundaries of the administrative area of Staffordshire County Council (SCC) and the local authority area of Lichfield District Council (LDC).

4.3.4 There are currently no continuous monitoring sites within the Whittington to Handsacre area.

4.3.5 Annual mean NO2 concentrations are measured by LDC using passive diffusion tubes at 22 locations. Only one measurement site is located within the Whittington to Handsacre area. This is a roadside site on the A38 at Fradley, 2.5km east of the centre line of the Proposed Scheme. This location is representative of concentrations surrounding the location where the A38 will be crossed by the Proposed Scheme. Further details of this monitoring site and the five year trend in concentrations are available in Volume 5: Appendix AQ-001-022.

4.3.6 The background air quality maps produced by Defra are considered to be a more appropriate source of baseline air quality conditions along the Proposed Scheme in the rural parts of the study area and indicate that the average background pollutant

[16] Defra; 2010 Based Background Maps for NOx, NO2, PM10 and PM2.5; http://laqm.defra.gov.uk/maps/maps2010.html; Accessed: 30 July 2013.

concentrations across the Whittington to Handsacre area are below the relevant air quality standards.

4.3.7 There are no AQMAs within the Whittington to Handsacre area.

4.3.8 Human receptors that could potentially be affected by changes in air quality as a result of the Proposed Scheme have been identified. Air quality at these receptors could potentially be affected, due to their proximity to construction activities, to roads with vehicle flows that may change or to roads that will be subject to realignment during the construction or operational phases of the Proposed Scheme. These locations are residential properties along Darnford Lane, west of Whittington; Mill Farm, Cappers Lane, east of Lichfield; Fulfen Cottages, Cappers Lane, east of Lichfield; on Broad Lane, Huddlesford; on Ash Tree Lane, Streethay; Streethay Farm, Burton Road, east of Streethay; The Manor House, Burton Road, north-east of Streethay; around Wood End Farm, Wood End Lane, Curborough; Wood End Lock Cottage, Wood End Lane, Curborough; Ravenshaw Cottage, Wood End Lane, Curborough; along Shaw Lane, Hanch; Ashton Hayes Farm, Tuppenhurst Lane, south-east of Handsacre; on Chestnut Close, Handsacre and Hayes Meadow Primary School, Handsacre.

4.3.9 There are no ecological receptors with statutory designations within the Whittington to Handsacre area. There are nine non-statutory designated sites within the Whittington to Handsacre area that could potentially be affected by changes in air quality as a result of the Proposed Scheme. These sites are Whittington Heath Golf Course Site of Biological Importance (SBI), north of the A51 Tamworth Road; Big Lyntus SBI, south of Wood End Lane, Curborough; Fradley Wood Biological Alert Site (BAS), north of Wood End Lane, Fradley; Wood End Lock (south-east of) SBI, north of Wood End Lane, Curborough; Ravenshaw Wood, Black Slough and Slaish SBI, north of Wood End Lane, Curborough; Tomhay Wood SBI, between the West Coast Main Line and Wood End Lane; Vicar's Coppice BAS, adjacent to the A515 Lichfield Road; John's Gorse SBI, west of the A515 and Tuppenhurst Lane (west of) SBI, south-west of Tuppenhurst Lane. These are all sites with local wildlife site (LWS) status. Further details of these sites are provided under the ecology topic in Section 7.

Future baseline

4.3.10 Section 2.1, Volume 5: Appendix CT-004-000 and Volume 5: Maps CT-13-061 to CT-13-065 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the future baseline for the assessment of effects from the construction and operation of the Proposed Scheme. In the Whittington to Handsacre area, there are no 'committed developments' that are considered to introduce new receptors requiring air quality assessment.

4.3.11 The data used for the air quality assessment take account of predicted changes in traffic, which are derived from a combination of regional traffic growth factors and consideration of major locally consented schemes, as described in the Traffic and Transport section. In this way, the assessment accounts for cumulative effects.

Construction (2017)

4.3.12 Future background pollutant concentrations have been sourced from Defra background maps for 2017, which predict NO2 and PM10 levels in 2017 to be lower than in the 2012 baseline.

Operation (2026)

4.3.13 Future background pollutant concentrations have been sourced from Defra background maps for 2026, which predict NO2 and PM10 levels in 2026 to be lower than in the 2012 baseline.

4.4 Effects arising during construction

Avoidance and mitigation measures

4.4.1 Emissions to the atmosphere will be controlled and managed during construction through the route-wide implementation of the CoCP, where appropriate. The draft CoCP (Volume 5: Appendix CT-003-000) includes a range of mitigation measures that are accepted by the IAQM as being suitable to reduce impacts to as low a level as reasonably practicable. It also makes provision for the preparation of Local Environmental Management Plans (LEMP) which will set out how the project will adapt and deliver the required environmental and community protection measures within each area through the implementation of specific measures required to control dust and other emissions from activities in the area.

4.4.2 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP (Volume 5: Appendix CT-003-000) will be implemented. These include:

- contractors being required to manage dust, air pollution, odour and exhaust emissions during construction works;
- inspection and visual monitoring after engagement with the local authorities to assess the effectiveness of the measures taken to control dust and air pollutant emissions;
- cleaning (including watering) of haul routes and designated vehicle waiting areas to suppress dust;
- keeping soil stockpiles away from sensitive receptors where reasonably practicable, also taking into account the prevailing wind direction relative to sensitive receptors;
- using enclosures to contain dust emitted from construction activities; and
- undertaking soil spreading, seeding and planting of completed earthworks as soon as reasonably practicable following completion of earthworks.

Assessment of impacts and effects

Temporary effects

4.4.3 Impacts from the 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 human receptors sensitive to dust and exposure to NO2 and PM10, as well as ecological receptors sensitive to dust.

4.4.4 An assessment of construction traffic emissions has also been undertaken for two scenarios in the construction period: a without the Proposed Scheme scenario and a with the Proposed Scheme scenario.

4.4.5 In the Whittington to Handsacre area, dust-generating activities will comprise demolition of buildings on the A51 Tamworth Road, Whittington Heath and around the A38 and Burton Road, Streethay; construction of the Streethay construction sidings; the construction of new structures; earthworks, including the movement of materials on the haul road along the line of the Proposed Scheme; as well as dust and mud deposited onto public highways from vehicles travelling to and from construction areas.

4.4.6 A construction dust assessment was undertaken for receptors at 13 locations where residential properties, one school and nine LWS were present, due to their close proximity to the dust generating activities associated with the Proposed Scheme. The residential locations are: Darnford Lane, west of Whittington; Mill Farm on Cappers Lane, east of Lichfield; Fulfen Cottages on Cappers Lane, east of Lichfield; on Broad Lane, Huddlesford; on Ash Tree Lane, Streethay; at Streethay Farm on Burton Road, east of Streethay; at The Manor House on Burton Road, north-east of Streethay; around Wood End Farm on Wood End Lane, Curborough; at Wood End Lock Cottage on Wood End Lane, Curborough; at Ravenshaw Cottage on Wood End Lane, Curborough; on Shaw Lane, Hanch; at Ashton Hayes Farm on Tuppenhurst Lane, south-east of Handsacre; and on Chestnut Close, Handsacre. The school is Hayes Meadow Primary School, Spode Avenue, Rugeley. The LWS are: Whittington Heath Golf Course SBI; Big Lyntus SBI; Fradley Wood BAS; Wood End Lock (south-east of) SBI; Ravenshaw Wood, Black Slough and Slaish SBI; Tomhay Wood SBI; Vicar's Coppice BAS; John's Gorse SBI; and Tuppenhurst Lane (west of) SBI.

4.4.7 Given the application of mitigation measures contained within the draft CoCP, the construction dust assessment determined that for the locations where residential properties were present the magnitude of impact will be slight adverse at Darnford Lane; Fulfen Cottages, Cappers Lane; on Broad Lane, Huddlesford; around Wood End Lane Farm, Wood End Lane; at Wood End Lock Cottage, Wood End Lane; at Shaw Lane; and at Ashton Hayes Farm on Tuppenhurst Lane due to the presence of residential properties within 20m of dust generating construction activities. The magnitude of impact will be negligible at the other locations, where residential properties are present, which lie beyond 20m from construction activities. The magnitude of impact will be slight adverse at Hayes Meadow Primary School as it will be within 20m of dust generating construction activities. The magnitude of impact will be negligible at other locations, as residential properties lie over 20m from dust-generating construction activities.

4.4.8 Overall, the construction dust assessment has determined that air quality effects will not be significant. The basis for this conclusion is presented in full at Volume 5: Appendix AQ-001-022.

4.4.9 Construction activity could also affect local air quality through the emissions associated with additional traffic generated on roads as a result of construction traffic routes, temporary road realignments and changes to traffic patterns arising from

temporary road diversions. Screening was undertaken to identify locations requiring assessment.

4.4.10 Three locations within the Whittington to Handsacre area met the criteria for assessment of change in traffic emissions during the construction phase. These locations are Cappers Lane, east of Lichfield; Broad Lane, Huddlesford and the A38 in Streethay. At all of these locations, the increase in construction traffic was sufficient to require an assessment of changes in concentrations at receptors around these roads. At Broad Lane there will also be a temporary road realignment which required assessment. The assessment found that the magnitude of impact for NO_2 will be slight adverse at Broad Lane and negligible at all other receptors assessed. For PM10 the magnitude of impact will be negligible for all receptors assessed.

4.4.11 The effect on air quality due to construction traffic emissions will not be significant. The basis for this conclusion is presented in full at Volume 5: Appendix AQ-001-022.

4.4.12 The Streethay rail siding will be constructed and will be in use for the duration of the construction period. Screening was undertaken to determine the effect on air quality due to the use of diesel trains at the sidings. Screening is based on the baseline air quality and distance of receptors from diesel trains. It is not required for the number of train movements to be considered for the screening. Baseline concentrations of annual mean NO_2 are less than 25µg/m^3, based on Defra background maps, and there are no human or ecological receptors within 30m of rail tracks used by diesel trains. On this basis the magnitude of impact will be negligible.

4.4.13 Therefore, effects on air quality anticipated to arise due to the use of the rail sidings during construction of the Proposed Scheme will not be significant.

Permanent effects

4.4.14 There are no permanent effects anticipated to arise during construction of the Proposed Scheme.

Cumulative effects

4.4.15 There are no cumulative effects anticipated to arise during construction of the Proposed Scheme.

Other mitigation measures

4.4.16 No other mitigation measures during construction are proposed in relation to air quality in this area.

Summary of likely residual significant effects

4.4.17 The methods outlined within the draft CoCP to control and manage potential air quality effects are considered effective in this location and no residual significant effects are considered likely.

4.5 Effects arising from operation

Avoidance and mitigation measures

4.5.1 No mitigation measures are proposed during operation in relation to air quality in this area.

Assessment of impacts and effects

4.5.2 Impacts from the operation of the Proposed Scheme will relate to changes in the volume, composition and distribution of road traffic. There are no direct atmospheric emissions from the operation of trains that will cause an impact on air quality and these have therefore not been assessed. Indirect emissions from sources such as rail wear and brakes have been assumed to be negligible. The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2026: a without the Proposed Scheme scenario and a with the Proposed Scheme scenario. The traffic data includes the additional traffic from future committed developments.

4.5.3 Traffic data in the Whittington to Handsacre area have been screened to identify roads that require an assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2026.

4.5.4 One location within the Whittington to Handsacre area met the criteria for an assessment of emissions from traffic during the operational stage, following completion of the Proposed Scheme. This location is Darnford Lane, west of Whittington, due to permanent realignment of Darnford Lane. The assessment at receptors around this road found that the magnitude of impact will be negligible at all receptors assessed for NO2 and PM10.

4.5.5 Therefore, the effect on air quality due to traffic following completion of the Proposed Scheme will not be significant. The basis for this conclusion is presented in full at Volume 5: Appendix AQ-001-022.

Cumulative effects

4.5.6 There are no cumulative effects anticipated to arise during operation of the Proposed Scheme.

Other mitigation measures

4.5.7 No other mitigation measures are proposed in relation to air quality in this area during operation.

Summary of likely residual significant effects

4.5.8 No residual significant effects are anticipated for receptors as a consequence of changes to air quality in this area during operation of the Proposed Scheme.

5 Community

5.1 Introduction

5.1.1 This section reports the impacts and likely significant effects on local communities resulting from the construction and operation of the Proposed Scheme.

5.1.2 Key issues concerning the community assessment for this area comprise:

- the demolition of residential properties, particularly in the Streethay area;
- amenity impacts for residents living close to the line of the route, near to temporary construction compounds or construction traffic routes, including those living to the west of Whittington and at Handsacre;
- the loss of land from a number of recreation facilities and open spaces which lie within the area of land required for the construction and operation of the Proposed Scheme, particularly in the Whittington area;
- impacts on access to day to day community facilities in the area, due to construction works and increased construction traffic in the area, particularly in the Whittington and Huddlesford areas.

5.1.3 Further details of the community assessments and recreational public right of way (PRoW) surveys undertaken within the area are contained in Volume 5: Appendix CM-001-022. Community assessment maps are provided in Volume 5: Maps CM-01-119 to CM-01-123.

5.1.4 The assessment draws upon information gathered from a combination of desktop studies, site surveys and through engagement with local organisations including Whittington Heath Golf Club and Lichfield Cruising Club.

5.2 Scope, assumptions and limitations

5.2.1 The assessment scope, key assumptions and limitations for the community assessment are set out in Volume 1, the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

5.2.2 Construction worker accommodation is located at the Cappers Lane and the A515 Lichfield Road main compounds. Construction worker impacts on community resources are considered at a route-wide level in Appendix CM-002-000. The assessment takes into account the number of workers, the type and location of accommodation, working hours, facilities provided on construction compounds, experience from other large projects (such as HS1) and the measures contained in the draft CoCP. On this basis it is concluded that there will be no significant effects associated with construction worker accommodation.

5.2.3 The construction and operation of the Proposed Scheme requires access rights over land at a number of locations within the Whittington to Handsacre area, both temporarily and permanently. In these instances, it is assumed that no construction works will be required and that there will be no loss of land from any residential

property or community resource as a result. Where the Proposed Scheme requires works along public highways, it is also assumed that no loss of land will be required from adjacent residential properties unless specifically identified in this section of the report. The Proposed Scheme requires the diversion of overhead power lines in the Streethay area. As a consequence, sections of the grid, both to the north and south of Streethay, will require tensioning and reinforcement works to cables and pylon towers. A corridor of land, approximately 100m wide, beneath the power lines has been identified as being required for these works. The limits of this corridor encompass a number of residential properties, however in these instances it is assumed that there will be no requirement to encroach directly into any of the domestic curtilages.

5.2.4 There are a number of non-residential and short term moorings situated close to the route of the Proposed Scheme within the Whittington to Handsacre area. These are described in the environmental baseline below and any effects due to a loss of land from these facilities during construction are also assessed. However, as explained in Volume 5 (SV-001-00) of this ES, temporary and static moorings with transitory use are not deemed to have a high sensitivity to noise impacts and on this basis the effects on the amenity of the users of these facilities are not addressed in this section of the report.

5.2.5 The A51 Tamworth Road is taken to represent the southern boundary of the Whittington to Handsacre area. The effects on residential properties and community resources on the south side of this road are addressed in the report for the neighbouring Drayton Bassett, Hints and Weeford area (CFA21).

5.3 Environmental baseline

Existing baseline

5.3.1 Baseline data on community resources was collected up to 1km from the centre line of the Proposed Scheme and, additionally, up to 250m from the boundary of land required for construction.

5.3.2 The study area includes the area of land within the construction boundary comprising of the land (both temporary and permanent) for the construction and operation of the Proposed Scheme, together with a wider corridor within which receptors or resources could be affected by a combination of significant residual effects, such as noise, vibration, construction dust, poor air quality and visual intrusion. In addition, the study area has regard to the proposed routeing of construction traffic and takes account of the catchment areas for community facilities that could be affected where crossed by the Proposed Scheme. Overall, the study area is taken as the area of land which encompasses the likely significant effects of the Proposed Scheme.

5.3.3 This area includes land within the parishes of Whittington, Fradley and Streethay, Kings Bromley, and Armitage with Handsacre.

Whittington Heath

5.3.4 The community of Whittington Heath comprises a cluster of residential properties focused around the site of DMS Whittington which is the headquarters for Defence Medical Services and is otherwise known as Whittington Barracks. A new medical

training facility together with associated accommodation is currently being built on the site. Family living accommodation wraps around the northern and eastern side of the barracks. There is a children's day care nursery at the barracks that is open to the general public, adjacent to which there is a community hall for use by MOD families. There are also recreational playing fields to the north and east of the barracks, which are used regularly by a local football club. The Staffordshire Regiment Museum is situated immediately north of the barracks and to the east of the route of the Proposed Scheme.

5.3.5 Facilities in this area are very limited. The Whittington Arms public house is situated on the south side of the A51 Tamworth Road and is within the boundary of the neighbouring Drayton Bassett, Hints and Weeford area (CFA21) to the south. The Whittington Heath Golf Club lies on the east side of the road. Whittington Heath falls within the catchment for the primary school and branch GP surgery at Whittington village to the north as well as the King Edward VI school (secondary) and other GP surgeries at Lichfield. The Proposed Scheme crosses the A51 Tamworth Road which is the main route used to access facilities at Lichfield, including secondary schooling.

5.3.6 Within this area, the study area includes the sports pitches for DMS Whittington and the Whittington Heath Golf Club. The assessment also considers the potential implications for access to community facilities for the community of Whittington Heath generally.

Whittington

5.3.7 Whittington is one of the larger villages in the area. It has a range of shops for everyday needs, together with a primary school, a branch GP surgery, a church, a hospice, a recreation ground and a number of community halls. The village of Whittington falls within the catchment of the King Edward VI school (secondary) at Lichfield and routes between the village and this school will be crossed by the Proposed Scheme. The catchment areas for some facilities located at Whittington, notably the primary school and the GP surgery, encompasses much of the surrounding rural hinterland.

5.3.8 As the centre of Whittington lies well beyond the area of land required for the construction of the Proposed Scheme, the study area includes only those residential properties on the western outskirts of the village which are in close proximity to the Proposed Scheme. The potential isolation effects on the overall community of Whittington are assessed given the dependency on routes which are crossed by the Proposed Scheme for access to facilities at Lichfield.

Huddlesford

5.3.9 The small village of Huddlesford is situated on the east bank of the Coventry Canal. It is approximately 450m to the east of the centre line of the route of the Proposed Scheme and beyond the area of land required for its construction and operation. The village has few facilities and falls within the catchment area for the primary school and GP branch surgery at Whittington and the King Edward VI school (secondary) at Lichfield. There is a pub in the village and the Lichfield Cruising Club has about 70 moorings along the Coventry Canal at Huddlesford together with the section of the Wyrley and Essington Canal extending to Cappers Lane in the south. The Coventry

Canal and its associated towpath pass through Huddlesford, heading to Streethay and Fradley junction in the north and to Whittington to the south.

5.3.10 The assessment considers the potential isolation effects on the entire community of Huddlesford and the study area also includes the Lichfield Cruising Club site.

Streethay

5.3.11 The urban edge of Lichfield extends close to the route of the Proposed Scheme at Streethay. There is a public house and a small play park at Streethay, both to the west of the Proposed Scheme and beyond the area of land required for the construction of the Proposed Scheme. A number of residential properties on the edge of Streethay are situated within the boundary of land required for the Proposed Scheme. Streethay falls within the catchment area for schools and health facilities at Lichfield which are beyond the study area for this assessment.

5.3.12 There are a number of recreational facilities to the east of the route of the Proposed Scheme at Streethay, including Streethay Wharf and the recently opened Kings Orchard Marina on the banks of the Coventry Canal. The area required for the construction of the Proposed Scheme includes a section of the Coventry Canal and its associated towpath, which passes to the east of the Proposed Scheme and land at the Horsepower Equestrian Centre at Streethay Farm. All of these facilities fall within the study area for the community assessment.

Fradley, Curborough and Hanch

5.3.13 Fradley is situated in the centre of the Whittington to Handsacre area and to the north-east of the Proposed Scheme. Significant development has taken place at Fradley over recent years, and the community has a modest range of facilities, including a church, a community hall, a primary school and some convenience shops. Further development is currently underway on the southern edge of Fradley which once completed will include a new GP surgery and a day care nursery. Fradley falls within the catchment area for the Friary School (secondary) at Lichfield.

5.3.14 The centre of Fradley and recent residential development to the south lie beyond the boundary of land required for the construction and operation of the Proposed Scheme, although the assessment considers the potential isolation implications for the community overall.

5.3.15 There are a number of recreational and visitor attractions close to the route of the Proposed Scheme that are included within the study area, including the Curborough Sprint Course at Netherstowe Lane and Midland Karting, the Dragonara Miniature Horse Stud and the Delta Force Paintballing centre at Wood End Lane. The study area also includes the Trent and Mersey Canal and its associated towpath, which are crossed by the Proposed Scheme to the north of Wood End Lane, along with a number of moorings in the area at Wood End Lock and at Kings Bromley Marina to the north. The Sustrans National Cycleway Route No. 54 passes through the study area at Fradley, running along Gorse Lane, Wood End Lane and Netherstowe Lane.

Handsacre

5.3.16 Handsacre, which merges with the adjoining settlement of Armitage, has a small number of shops, halls, churches, open spaces and pubs, together with a local police station, GP surgery, day care nursery and primary school.

5.3.17 The study area for the assessment includes residential properties on the south side of the town close to the route of the Proposed Scheme, together with the Hayes Meadow Primary School (and nursery) which is situated alongside the existing west coast mainline.

5.3.18 Handsacre itself lies within the catchment area for the Hagley Park Academy at Rugely, which is beyond the Whittington to Handsacre study area.

Future baseline

Construction (2017)

5.3.19 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. Within the scope of this topic assessment, relatively little change is anticipated to the baseline conditions along the route of the Proposed Scheme in the Whittington to Handsacre area prior to the commencement of construction.

5.3.20 As noted above, DMS Whittington is currently being redeveloped to incorporate a new medical training facility. Existing buildings fronting on to the A51 Tamworth Road will be replaced with a new Army Development and Selection Centre, a training block and a library and lecture theatre block whilst living accommodation is to be sited on the north-east part of the site, further away from the Proposed Scheme. Planning permission has also been granted for refurbishment of the playing pitches to the north of the barracks, including the provision of a new all weather pitch with floodlighting. The barracks are beyond the area of land required for the construction and operation of the Proposed Scheme, whilst a very small area of the playing fields is within the boundary.

5.3.21 There is also an extant planning permission for the conversion of an agricultural building at Whittington Hill Farm to form an additional dwelling at the site, which is close to the boundary of land required for the construction and operation of the Proposed Scheme. Works have already commenced to convert an outbuilding at Ellfield House to residential use, this building lies within the boundary of land required for the Proposed Scheme. Further expansion of Kings Orchard Marina near Streethay is envisaged over the coming year with plans to increase the number of moorings from 45 to 89 in line with the planning permission for this site. The Marina is adjacent to the boundary of land required for the construction and operation of the Proposed Scheme.

Operation (2026)

5.3.22 The review of future baseline conditions has not identified any additional committed developments, within the study area, which will be completed by the year of operation.

5.4 Effects arising during construction

Avoidance and mitigation measures

5.4.1 The following measures have been incorporated into the scheme design as part of the design development process to avoid or reduce the environmental impacts during construction:

- redesigning the profile of earthworks to reduce the amount of land that will be required from residential properties close to the route, including land that will be required temporarily during construction;
- reducing the extent of earthworks to reduce or avoid the need for land from recreational spaces in the area, including the Midland Karting site at Wood End Lane, Fradley and the Delta Force Paintballing site also at Wood End Lane;
- incorporating a retaining wall structure to reduce or avoid the need for land required for the construction and operation of the Proposed Scheme from adjoining properties, including from residential properties at Handsacre;
- making provision within the land required for construction of the Proposed Scheme for the temporary re-routing of local roads to limit disruption to traffic during the works, including for Lichfield Road, Broad Lane and the A515 Lichfield Road;
- re-siting one of the proposed construction compounds to reduce the amenity impact on Kings Bromley Marina; and
- provision of hoardings alongside the construction site boundary to reduce noise impacts on nearby residential properties, including near Ellfield House at Lichfield Road, Whittington and at Handsacre, as well as beside the Hayes Meadow Primary School.

5.4.2 The draft CoCP includes a range of provisions that will help mitigate community effects associated with construction within this area, including the following (see Volume 5: Appendix CT-003-000):

- appointment of community relations personnel (draft CoCP, Section 5);
- community helpline to handle enquires from the public (draft CoCP, Section 5);
- sensitive layout of construction sites to reduce nuisance (draft CoCP, Section 5);
- where reasonably practicable, maintenance of PRoW for pedestrians, cyclists and equestrians around the perimeter of construction sites and across entry and exit points (draft CoCP, Section 5);
- monitoring and management of flood risk and other extreme weather events which may affect community resources during construction (draft CoCP, Sections 5 and 16);
- specific measures in relation to air quality and noise will also serve to reduce impacts for the neighbouring communities including discretionary noise

insulation for sensitive community resources and, in special circumstances, temporary re-housing (draft CoCP Sections 7 and 13); and

- where reasonably practicable, the avoidance of large goods vehicles operating adjacent to schools during drop off and pick up periods (draft CoCP, Section 14).

Assessment of impacts and effects

5.4.3 Details of all assessments of community resources are included in Volume 5: Appendix CM-001-022. Each assessment form presents information that explains the rationale for determining the rating for sensitivity of the affected community resource, magnitude of impact and the assessment of significance.

Whittington Heath

Temporary effects

Community facilities

5.4.4 No significant temporary effects have been identified on community resources in Whittington Heath due to construction of the Proposed Scheme. The slight temporary loss of land from the boundary of the sports fields to the north of DMS Whittington will have a negligible effect and community facilities at the barracks, the Staffordshire Regiment Museum and the Whittington Pre School will not be directly affected or subject to a combination of significant amenity effects. Isolation effects on the community of Whittington Heath will be negligible as the A51 Tamworth Road will be maintained to allow access to facilities at Lichfield and there will be no impact on Common Lane, which provides access to facilities at Whittington.

Permanent effects

Open space

5.4.5 The route of the Proposed Scheme passes through the centre of the Whittington Heath Golf Club. Its construction will require the demolition of the clubhouse and the permanent loss of the car park. The railway itself will require the permanent loss of a 100m wide corridor of land through the centre of the course, effectively severing the course in two and resulting in the loss of fairways and greens within its footprint. Approximately five of the eighteen holes fall wholly or partly within the boundary of land required for the construction and operation of the Proposed Scheme, leaving eight holes largely unaffected on the west side and five on the east side. This loss of land will completely compromise the function and quality of the course. Even with significant re-design, it is unlikely that there will be sufficient space to be able to accommodate 18 holes of comparable playing standard within the Golf Club's current boundary, together with replacement clubhouse and parking facilities.

5.4.6 In terms of the severance of the course, whilst the design of the Proposed Scheme makes provision for a single footpath underpass in the centre of the course, (to maintain the PRoW Whittington 16), no further bridges or underpasses are proposed. On this basis, the course will remain largely severed with poor connectivity between the two parcels either side of the railway. Given the location of the proposed PRoW 16 underpass and the orientation of the fairways at present, it is also likely to be difficult to connect the two separate parcels on the course in a way that offers a coherent

playing order and appropriate linkages with any replacement clubhouse facilities. For these reasons, it is considered that the construction of the Proposed Scheme will effectively render continued play over 18 holes at the course impracticable, substantially diminishing its playing offer. Instead, it is assumed that only a 9 hole course can realistically be maintained on the west side of the Proposed Scheme requiring only limited shortening or modifications to one or two fairways and assuming that a suitable site can be agreed for a replacement clubhouse and parking area. Overall, taking all factors into account, the severance of the golf course and the loss of land and buildings are assessed as giving rise to a major adverse effect on the Whittington Heath Golf Club and its users, which is therefore significant.

Whittington

Temporary effects

Residential properties

5.4.7 No significant temporary effects on the community of Whittington have been identified during construction of the Proposed Scheme.

5.4.8 The construction of the Proposed Scheme will require some slight temporary loss of land from one residential property in this area, namely High View at Darnford Lane, the effects of which are assessed as minor and not significant at a community level.

5.4.9 Residents of Whittington village will also be affected by works to Lichfield Road, Darnford Lane and Cappers Lane to the west of the village, all of which are crossed by the Proposed Scheme. These are the key routes between the village and facilities at Lichfield including secondary schooling. As explained in the traffic and transport section of this report (Section 12) no significant increases in congestion or delays are predicted in this area as a result of the construction works. On the basis, the isolation effects on the community of Whittington are assessed as minor and not significant.

Community facilities

5.4.10 The Proposed Scheme crosses through the priority catchment area for Whittington Primary School, which extends to include Hints, Weeford and Whittington Heath to the south and Huddlesford to the north. The school is dependent upon children travelling into the village from outlying areas beyond its catchment to make up its full roll and about 15% of its pupils currently travel in from Lichfield, the routes from which will be crossed by the Proposed Scheme. As no significant increases in congestion or delays are predicted in the Whittington area (see Section 12) and given that only about one-sixth of pupils are likely to be affected, the isolation effects on the school will be negligible.

Open space

5.4.11 The construction of the Proposed Scheme requires the diversion of overhead powerlines to the north of Cappers Lane. As a consequence of this work, it will also be necessary to modify some pylon towers either side of this diversion and to tension cables along the nearest adjoining sections of the grid. A corridor of land has been identified beneath the overhead powerlines to the west of Whittington within which access will be required to undertake these works. This includes a corridor of land,

approximately 100m wide through the centre of the Moors Golf Course belonging to Darnford Moors Golf Club.

5.4.12 The works in this area are likely to entail the erection of scaffolding and netting to secure the power cables from beneath whilst tensioning operations are carried out. In addition, works will be required to reinforce the two existing pylon tower structures. As the alignment of the overhead powerlines bisects seven of the nine fairways on the golf course, it is likely that the entire course will need to be closed during these operations. Although detailed programme for these operations has yet to be developed, it is assumed that complete closure of the Moors Course is likely to be necessary for a short period of time within the overall 15 month programme for the diversion works. No land will be required from the adjacent Academy Course.

5.4.13 The temporary closure of the Moors Course will diminish the overall offer of the Club and will further reduce opportunities for playing golf in the area particularly as the Proposed Scheme also affects the nearest available alternative at Whittington Heath. Although the Club's driving range and Academy course will not be affected, the closure of the Moors Course, albeit for what is likely to be a short period of time, is therefore assessed as a moderate adverse effect, which is significant.

Permanent effects

Residential properties

5.4.14 The construction of the Proposed Scheme will require the demolition of one residential property in the Whittington area, namely an outbuilding at Ellfield House, Lichfield Road, which is currently being converted to residential use. It will also require the permanent loss of land and the demolition of an outbuilding from a further residential property, namely Ivy Cottage at Broad Lane. The loss of a single residential property and the loss of land from a single property, which are not significant at a community level.

Huddlesford

Temporary effects

Residential properties

5.4.15 No significant amenity effects on the community of Huddlesford have been identified during the construction period. Residents will however be affected by works to Broad Lane, which connects the small hamlet to Lichfield in the west will affect journeys to access facilities such as secondary schooling, however as no significant increases in congestion or delays have been identified, these isolation effects are assessed as minor and not significant.

Community facilities

5.4.16 Part of the Lichfield Cruising Club site at Huddlesford falls within the boundary of land required for the construction and operation of the Proposed Scheme. The permanent effects on the Cruising Club are described later in this section. During the construction period, works to build the Cappers Lane viaduct structure and associated earthworks for the Fulfen Wood south embankment will require land from part of the Cruising Club site. The area affected includes the Cruising Club's slipway and boat maintenance area and adjacent car parking immediately to the north of Cappers Lane.

The works are expected to take approximately 18 months to complete depending upon the precise phasing of earthworks for the embankment. The loss of this land temporarily will therefore preclude continued use of the car park and slipway facilities during this time, which are typically in use all year round. In addition, it is likely that a small number (less than ten) of moorings immediately to the north of slipway will also need to be closed during construction works for the viaduct and supporting earthworks. In all, given the importance of the boat maintenance area to the functioning of the Club and the limited scope to accommodate any displaced moorings elsewhere on the Club's site, the temporary loss of land will give rise to a moderate adverse effect on the Club during construction, which is significant.

Permanent effects

Community facilities

5.4.17 As explained above, the area of land required for the construction and operation of the Proposed Scheme includes part of the site used by the Lichfield Cruising Club at Huddlesford. The Proposed Scheme incorporates a new access to the Club's parking area at Cappers Lane, but shows all of the land currently used for car parking and boat maintenance to the north of Cappers Lane, along with the Club's slipway as being required permanently. In practice, only the space occupied by one of the viaduct supporting piers is likely to be lost permanently from this area, with access being required for maintenance purposes. However, the presence of this structure will potentially constrain use of the remaining space and the ability to manoeuvre boats and vehicles accessing the slipway. On this basis, the construction of the Proposed Scheme will permanently impair the club's operations and activities. Given the lack of suitable alternative space within the Club's current boundary to relocate such boat manoeuvring operations, the impact has been assessed as giving rise to a moderate adverse effect on the Lichfield Cruising Club, which is significant.

Streethay

Temporary effects

Residential properties

5.4.18 No significant temporary effects on the community of Streethay have been identified during the construction of the Proposed Scheme.

Community facilities

5.4.19 The Horsepower Equestrian Centre at Streethay Farm lies partly within the boundary of land required both temporarily and permanently for the construction and operation of the Proposed Scheme. During the construction period, the equestrian centre will lose about two-thirds of its site, including the grazing land for keeping horses to the south of the South Staffordshire railway line, paddocks to the north of the railway and the outdoor arena in which some of the riding lessons are held. The loss of this amount of grazing land together with the arena will compromise the ability of the centre to function at its present level of operation. The Equestrian Centre currently provides riding lessons for all ages and offers all day events during school holidays. It is also a designated centre for the Pony Club, hosting a series of regular events and meetings. As the land could be required for a period of up to six years, the impact on this well used facility is assessed as giving rise to a major adverse effect which is

significant. The effects of the permanent loss of land on the Equestrian Centre are assessed later in this section of the report.

Recreational PRoW

5.4.20 The Coventry Canal and its associated towpath pass to the east of the Proposed Scheme between Streethay and Huddlesford. Two sections of the canal and towpath, each approximately 100m in length, fall within the area required temporarily for the construction of the Proposed Scheme. This will have a negligible effect as no closures of the canal or its towpath are anticipated, either temporarily or permanently.

5.4.21 It is however recognised that users of the canal and towpath will be subject to noise impacts and significant visual effects as a result of proximity to the construction works for the Proposed Scheme. Given the transitory nature of these recreational resources, the impacts of construction noise are not considered to affect users significantly and on this basis no significant effect has been identified within the scope of this topic assessment.

Permanent effects

Residential properties

5.4.22 The Proposed Scheme will require the demolition of six residential properties in the Streethay area, as follows:

- Field Cottage; Streethay Cottage and Elverceter, which are situated immediately to the north of the A38 Burton Road;
- Two residential properties at Hill Farm, which are situated within the area of land required temporarily for the stockpiling of materials adjacent to the proposed Streethay construction sidings; and
- Rough Stockings, which is situated just to the north of Streethay and the A38.

5.4.23 The loss of this number of residential properties is assessed as a moderate adverse and significant effect at a community level.

Community facilities

5.4.24 As noted above, the Proposed Scheme will result in the permanent loss of grazing land from the Horsepower Equestrian Centre at Streethay. On the basis that the other land required temporarily during construction will be returned back to the equestrian centre upon completion of the works, this loss is unlikely to compromise the overall functioning of the centre, and its loss is assessed as a minor adverse effect, which is not significant.

Fradley, Curborough and Hanch

Temporary effects

Residential properties

5.4.25 The community of Fradley will not be significantly affected during the construction of the Proposed Scheme. The village centre and the more recent housing estate and facilities to the south are too far from the construction works to be affected by significant amenity impacts and given the phasing and nature of the works on the A38

and Wood End Lane, the effects on access to facilities at Lichfield, including secondary schooling will be negligible.

Community facilities

5.4.26 The Proposed Scheme crosses directly over the Trent and Mersey Canal at Wood End Lock. During construction, there are approximately 15 leisure moorings beneath the working area for the Trent and Mersey Canal west viaduct which will need to be closed temporarily. These will be lost for a period of approximately 13 months until completion of the viaduct structure. The temporary loss of these moorings is assessed as giving rise to a major adverse effect on boat users along this busy and popular section of canal, which is therefore a significant effect.

5.4.27 It is anticipated that other moorings in this area located to the south of the Trent and Mersey Canal west viaduct worksite will remain operational during the construction period as they are not directly beneath the working area.

5.4.28 The Proposed Scheme will also require small areas of land from the entrance to the Curborough Sprint Course at Netherstowe Lane, from the western edge of the Delta Force Paintballing centre at Wood End Lane and along the boundary of the Kings Bromley Marina. These losses of land will not give rise to significant effects on the sites or their users.

5.4.29 Users of the Midland Karting site and the Dragonara Miniature Horse Stud at Wood End Lane will not be affected by a combination of significant amenity effects.

Open space

5.4.30 Access to two electricity pylon towers situated within the grounds of the Lichfield Golf and Country Club will be required during construction of the Proposed Scheme, to carry out reinforcement works associated with the diversion of cables near the route of the Proposed Scheme. The area of land required temporarily around the pylons will not affect the adjacent 2nd, 6th and 8th greens but will encroach slightly into the 9th tee area, which may require some temporary modification. As works at the pylon are only likely for a short period of time, the slight encroachment onto the golf course is assessed as a minor adverse effect which is not significant.

Recreational PRoW

5.4.31 The Trent and Mersey Canal to the north of Wood End Lane at Fradley is crossed by both the mainline and the Manchester Spur elements of the Proposed Scheme. Two sections of the canal and towpath fall within the area identified as being required for the construction and operation of the Proposed Scheme. As the canal and towpath will be maintained, their inclusion within the boundary will have a negligible effect on their function.

5.4.32 It is however recognised that users of the Trent and Mersey Canal and towpath will be affected by a change in amenity during construction of the viaduct structures overhead. Users of the route will be subject to significant adverse visual effects and given the proximity to the works they will also be affected by noise impacts. However, given the transitory nature of this recreational route, these noise impacts are not considered to give rise to a significant effect on users. On this basis, a combination of significant amenity effects on users of the canal and towpath has not been identified.

5.4.33 Part of the Sustrans National Cycle Network Route No. 54, which runs along Netherstowe Lane and Wood End Lane at Fradley lies within the limits of land required for the construction and operation of the Proposed Scheme. As these roads will be maintained during construction, the effects on the function and use of the cycle route will be negligible.

Permanent effects

Residential properties

5.4.34 No significant permanent effects have been identified on community resources in Fradley, Curborough and Hanch due to construction of the Proposed Scheme.

5.4.35 The construction of the Proposed Scheme will require the demolition of one residential property in this area, namely Hanchwood House at Shaw Lane, and the permanent loss of land from a further property, namely Ravenshaw House, at Wood End Lane, near Curborough. These losses are not significant at a community level.

Handsacre

Temporary effects

Residential properties

5.4.36 No significant temporary effects on community resources have been identified.

5.4.37 Some residents close to the route of the Proposed Scheme will be subject to significant visual impacts during the construction works, but none of these will also experience significant noise. Similarly, the Hayes Meadow Primary School will have significant adverse visual effects during construction but will not experience significant noise effects.

Permanent effects

Residential properties

5.4.38 No significant permanent effects have been identified on community resources in Handsacre due to construction of the Proposed Scheme.

5.4.39 The construction works at Handsacre will require the permanent loss of land from two residential properties in this part of the study area, namely from:

- Ashton Hayes Farm; and
- No. 29 Chestnut Close.

5.4.40 The loss of land from two residential properties is assessed as a minor adverse effect which is not significant at a community level.

Cumulative effects

5.4.41 No cumulative or community wide effects on community resources as a result of the construction of the Proposed Scheme have been identified in the Whittington to Handsacre area.

Other mitigation measures

5.4.42 The assessment has concluded that construction of the Proposed Scheme will give rise to a small number of significant adverse effects on community resources in the

Whittington to Handsacre area. Whilst no further mitigation has been identified at this stage, HS2 Ltd will work closely with the owners of the following affected community resources to assist them reconfigure their operations or to identify suitable compensatory land on the basis that they will be eligible for financial compensation under the National Compensation Code:

- Whittington Heath Golf Club;
- Lichfield Cruising Club; and
- Horsepower Equestrian Centre at Streethay Farm.

Summary of likely significant residual effects

5.4.43 Construction of the Proposed Scheme will give rise to a small number of residual significant effects on community resources within the Whittington to Handsacre area. These are shown in Volume 2: Maps CM-01-119 to CM-01-123.

5.4.44 In the south of the area, the loss of land from Whittington Heath Golf Club, the demolition of the Club house and the severance of the golf course will give rise to a major adverse permanent effect, substantially reducing the playing offer of this club. A temporary closure of the Moors Course at the Darnford Moors Golf Club will result in a moderate adverse effect on the Club's members and visitors. The use of Lichfield Cruising Club's car park at Cappers Lane will preclude access to the Club's slipway and boat maintenance area during construction and the siting of one of the piers for the Cappers Lane viaduct in this area will partly impair use of their site permanently. These impacts will give rise to moderate adverse effects on the Club and its members both during and after completion of the Proposed Scheme.

5.4.45 In the centre of the area at Streethay, the demolition of six residential properties will give rise to a permanent moderate adverse effect. The temporary loss of land from the Horsepower Equestrian Centre at Streethay Farm, given the extended period of time over which this is required, will compromise this recreational resource, giving rise to a major adverse effect. Works to construct the viaduct structures over the Trent and Mersey Canal will require the temporary closure of approximately 15 moorings in the vicinity of Wood End Lock, which given the demand and popularity of boating in this area will give rise to a major adverse effect.

5.4.46 No significant temporary or permanent effects on community resources at Handsacre have been identified.

5.5 Effects arising from operation

Avoidance and mitigation measures

5.5.1 As part of the design development process for the Proposed Scheme, a number of measures have been incorporated within the proposals, to avoid or reduce effects on the amenity of community resources during operation. In particular, the design incorporates a combination of:

- Provision of landscape earthworks and new planting to reduce visual impacts on residential properties close to the route of the Proposed Scheme; especially at Whittington, Streethay, near Wood End Lane at Fradley and the A515

Lichfield Road. Further information on noise mitigation measures can be found in the sound, noise and vibration section of this report (Section 11).

Assessment of impacts and effects

5.5.2 The operation of the Proposed Scheme will give rise to a combination of significant amenity effects on a small number of residents in the Whittington and Handsacre area.

5.5.3 Further details of the community assessments during the operation of the Proposed Scheme are provided in Volume 5: Appendix CM-001-022.

Whittington

Residential properties

5.5.4 The operation of the Proposed Scheme will generate a combination of significant noise and visual effects on the residents of ten properties on the western outskirts of Whittington. The change in amenity for residents is assessed as giving rise to a major adverse effect, which is significant. The properties that will be affected are situated between Lichfield Road and Darnford Lane and are as follows:

- Ellfield Lodge, Ellfield House and Ellfield Cottage which are situated to the east of the Proposed Scheme at Lichfield Road;
- Marsh Cottage which is situated to the west of the Proposed Scheme at Marsh Lane; and
- Marsh Farm, Whittington Hill House, Whittington Hill Farm (including the extant permission for a second dwelling at this location), Rodrest and High View which are situated on either side of the Proposed Scheme at Darnford Lane.

Handsacre

Residential properties

5.5.5 The residents of five properties at Handsacre will be affected by a combination of significant noise and visual effects due to the operation of the Proposed Scheme. The change in amenity for these residents is assessed as a major adverse effect, which is significant. The properties that will be affected are:

- No. 15 Spode Avenue; and
- Nos. 27, 29, 31 and 33 Chestnut Close.

Cumulative effects

5.5.6 No cumulative or community wide effects have been identified within any part of the Whittington to Handsacre area during operation.

Other mitigation measures

5.5.7 No further mitigation has been identified.

Residual significant effects

5.5.8 The assessment has concluded that a small number of households on the western outskirts of Whittington and on the edge of Handsacre will experience a reduction in amenity due to a combination of significant noise and visual effects from the operation of the Proposed Scheme. The change in amenity for these residents will give rise to a major adverse effect in both cases, which is significant.

5.5.9 The location of the properties affected during operation of the Proposed Scheme is shown in Volume 2: Maps CM-01-119 to CM-01-123.

6 Cultural heritage

6.1 Introduction

6.1.1 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. Consideration is given to the extent and heritage value (significance) of assets including archaeological and palaeo-environmental remains; historic buildings and the built environment; and historic landscapes.

6.1.2 With regard to heritage assets, the main issue is the extent to which designated and non-designated assets are affected by the Proposed Scheme. Impacts on assets as a result of the Proposed Scheme will occur largely through the physical removal and alteration of assets and changes to their setting.

6.1.3 Maps showing the location of the key environmental features can be found in Volume 2: Community Forum Area (CFA) map books. Maps showing the location of all designated and non-designated heritage assets can be found in Volume 5: Map Book – Cultural heritage. Detailed reports on the cultural heritage character and surveys undertaken within the local area are contained in the Volume 5 Appendices. These include:

- Appendix CH-001-022 – Baseline report;
- Appendix CH-002-022 – Gazetteer of heritage assets;
- Appendix CH-003-022 – Impact assessment table; and
- Appendix CH-004-022 – Survey reports.

6.1.4 Throughout this section, assets within the study areas are identified with a unique reference code, WHAxxx; further detail on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-022.

6.1.5 Engagement has been undertaken with the Staffordshire County Council with regard to the nature of the cultural heritage assets within the local area.

6.2 Scope, assumptions and limitations

6.2.1 The assessment scope, key assumptions and limitations for the cultural heritage assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

6.2.2 The setting of all designated heritage assets up to 2km of the centre line has been considered. 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, temporarily or permanently, to construct the Proposed Scheme plus 500m.

6.2.3 The cultural heritage methodology includes the consideration of the intra-project effects of a number of technical topic assessments, for example, landscape and visual,

ecology and water resources and flood risk. Consequently, these interactions have been included in the assessment of impacts and effects.

6.2.4 In undertaking the assessment the following limitations were identified:

- the LiDAR[17] data examined did not encompass the full extent of the study area; and
- not all areas of survey as identified in the archaeological risk model[18] were available for survey.

6.2.5 However, non-intrusive field survey was undertaken in a number of areas to provide data regarding the nature of sub-surface archaeological assets. Information from other sources of data, including the Historic Environment Record and local archives was utilised to provide information relating to the potential archaeological assets that may be present.

6.3 Environmental baseline

Existing baseline

6.3.1 In compiling this assessment, documentary baseline data was collected from a variety of sources as set out in Volume 5: Appendix CH-001-022.

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

- walkover and site reconnaissance from areas of public access or in locations where access was granted. This was undertaken to understand the character and form of heritage assets and the historic landscape, to review the setting of assets, and to identify previously unknown assets;
- desk-top review of remote sensing data including LiDAR, aerial photographs and hyperspectral data (see Volume 5: Appendix CH-004-022); and
- a programme of non-intrusive surveys including geophysical surveys (see Volume 5: Appendix CH-004-022).

Designated assets

6.3.3 The following designated heritage assets are located partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme (see Volume 5: Map Book — Cultural heritage, Maps CH-01-061B through CH-01-065):

- a Grade II listed milepost on the Coventry Canal between King's Orchard Bridge and Stoney Step Bridge (WHA309);
- ancient woodland at Ravenshaw Wood (WHA222) and John's Gorse (WHA226); and
- the Trent and Mersey Canal conservation area (WHA340).

[17] Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.
[18] The archaeological risk model is an approach that enables the identification of those areas of the Proposed Scheme where archaeological assets are known or suspected and provides a mechanism for the prioritisation of the programme of survey.

6.3.4 The following designated assets are located within the 2km study area (see Volume 5, Map Book — Cultural heritage, Map CH-02-37 through CH-02-38):

- Streethay Manor and moated site (WHA132), a scheduled monument and listed building, with a further listed building (a 17th century plunge bath) in the grounds;
- Handsacre Hall moated site, a scheduled monument (part of WHA326);
- two grade I listed buildings (both within the village of Mavesyn Ridware (WHA203);
- eight grade II* listed buildings: two within the hamlet of Hill Top (WHA174), one in Longdon (WHA180), one in Armitage (WHA197), one in Mavesyn Ridware (WHA 203), High Bridge (WHA212), Whittington Old Hall (within WHA304) and Hanch Hall (WHA325);
- 91 grade II listed buildings, predominantly within the settlements at Whittington (WHA304), Longdon Gren (WHA165),on the Trent and Mersey/Coventry Canals at Fradley Junction (WHA150) and at Wood End Lock (WHA338) and within the city of Lichfield, as well as isolated rural farms at Huddlesford Grange Farm (WHA122), Streethay House Farm (WHA359), Curborough Farmhouse (WHA138), Hanch Hall Farm (WHA325) and Tuppenhurst Farmhouse (WHA188);
- five conservation areas: Fradley Junction (WHA150), Longdon Green and Hill Top (WHA165), Mavesyn Ridware (WHA203), Kings Bromley (WHA218) and Whittington Village (WHA304); and
- five areas of ancient woodland: Big Lyntus (WHA221), Slaish (WHA223), Tomhay Wood (WHA224), Vicar's Coppice (WHA225) and Brookhay Wood (WHA376).

Non-designated assets

6.3.5 The following non-designated assets of moderate value lie wholly or partially within the land required, temporarily or permanently, for the construction of the Proposed Scheme:

- Whittington Heath Golf Course clubhouse (WHA302);
- Coventry Canal including King's Orchard Bridge and Stoney Step Bridge (WHA309);
- four lengths of Important Hedgerow[19]: Tamworth Road (WHA330), Streethay parish boundary (WHA331), Pyford Brook (WHA332) and Tewnals Lane (WHA334); and
- nine archaeological sites: medieval moated site (WHA310), ring ditch (WHA311), enclosure (WHA312), medieval Streethay (WHA 314), Ravenshaw Wood relict fields (WHA321), Roman landscape at Streethay (WHA315),

[19] Schedule One, Part II of the 1997 Hedgerows Regulations.

medieval Fulfen (WHA307), prehistoric landscape at Bourne Brook(WHA324) and medieval Handsacre (WHA326).

6.3.6 The following identified non-designated assets of low value lie wholly or partially within the land required, temporarily or permanently, for the construction of the Proposed Scheme:

- Whittington Heath Golf Course (WHA303);
- cottage called 'Rough Stockings' (WHA046);
- Field Cottage, Streethay Cottage and Elverceter (WHA039);
- Hanchwood House (WHA080);
- milepost on the Tamworth Road (WHA 091);
- Hill Farm, Streethay (WHA 090); and
- six archaeological sites: the disused Lichfield Canal (WHA308), medieval Curborough (WHA 318), former RAF Lichfield (WHA316), cropmarks at Wood End (WHA344), cropmarks at Brokendown Wood (WHA345) and Bunyan's Mill at Mill Farm (WHA306).

6.3.7 All non-designated heritage assets within 500m of the land required, temporarily or permanently, for the construction of the Proposed Scheme are listed in the gazetteer in Volume 5: Appendix CH-002-022 and identified on maps CH-01-061B through CH-01-065. There is a number of built heritage assets the settings of which have been considered, for example:

- All the Winds (WHA009);
- Bailey's Beating (WHA010);
- Thimble Hall Cottage (WHA013);
- Marsh Farm (WHA024);
- Wren Cottage (WHA025);
- Darnford Lane Cottages (WHA026);
- Boot Farm Cottage (WHA027);
- Holly Cottage (WHA028);
- Ellfield House and Lodge (WHA018);
- Whittington Hill House and Hill Farm (WHA022);
- The Lichfield Canal – Wyrley and Essington branch (WHA308);
- The Coventry Canal (WHA309);
- Structures on the Trent and Mersey Canal (WHA340);
- Fulfen Farm (WHA032);

- The Plough PH (WHA034);
- The Anchor PH (WHA038);
- Orchard Farm (WHA045);
- Ravenshaw Cottage (WHA067);
- Cranberry (WHA068);
- Common Farm (WHA364);
- Woodend Common Barn (WHA065);
- Woodend Farm (WHA062);
- Black Slough Farm (WHA066);
- Vicar's Coppice House (WHA072);
- Shaw House (WHA079);
- Ashton Hayes (WHA082);
- Westview Cottages (WHA085);
- Newtown (WHA083); and
- Barn (WHA089).

Cultural heritage overview

6.3.8 The geology of the study area is predominantly mudstone with some sandstone deposits around Whittington Heath. This geology, which is typical of central Staffordshire and the upper part of the River Trent catchment, forms neutral clay-rich soils which often support woodland and pasture, common to the study area. The study area lies 4km from the River Tame at Whittington Heath, and only 2km from the River Tame at Streethay, running between 3km and 2km from the River Tame for the remainder of the route. The River Trent is 1km north of the northern end of the Scheme. Further details of the geology of the area are contained in Section 8, Land Quality.

6.3.9 The study area is relatively low-lying, around or below 100m AOD. Whittington Heath lies on relatively high ground at approximately 100m AOD, but heading north the Proposed Scheme corridor drops away to approximately 60m AOD at Mill Farm. Sandstone outcrops give rise to some low hills such as at Whittington Hill Farm and Hill Farm at Streethay (both approximately 85m AOD). The Proposed Scheme runs at approximately 65m AOD from Streethay towards Wood End Farm, where it rises to run along a 75m AOD terrace for the remainder of the route.

6.3.10 Running east across the Proposed Scheme from the Tame and Trent Valleys, three alluvial channels represent former and current river and stream beds. The first runs from Huddlesford across the Proposed Scheme to the mills on the brook at Mill Farm (WHA306) and Darnford (WHA305), in the area of the Mare, Darnford and Fulfen Brooks. The second follows the old course of the Curborough/Pyford Brook near Wood End Lock (WHA344, WHA345). The third crosses the Proposed Scheme at

Seedy Mill, running east from Kings Bromley Marina (the Bourne Brook) (WHA324). The potential for as yet unknown palaeo-environmental or other archaeological evidence to survive on or near these watercourses is considered to be high. For this reason asset numbers have been allocated to extended areas around these watercourses (Mare Brook prehistoric landscape WHA320, Bourne Brook prehistoric landscape WHA324, and WHA344 and 345 on the Pyford Brook).

6.3.11 The landscape of the Whittington to Handsacre area is predominantly an 18th and 19th century rural landscape with isolated examples of earlier (medieval) buildings. Apart from the canals and associated structures, the built heritage of the area is largely represented by dispersed settlement between villages – predominantly farmsteads and rural buildings, as well as the remains of the estates and grounds of some grander houses such as Freeford Manor (WHA300), Hanch Hall (WHA325), Elmhurst Hall (WHA323) and the Manor House at Streethay (WHA132).

6.3.12 The centre line of the route passes within 1km of Whittington (WHA304) and ends at Handsacre (WHA326), both of which are settlements of medieval origin with significant modern development on their outer edges near to the Proposed Scheme. The centre of Lichfield is less than 2km from the Proposed Scheme, and its modern built-up area extends through Streethay to the Proposed Scheme itself. North and south of Streethay, the Proposed Scheme runs well away from any concentrations of historic settlement until it reaches Handsacre.

6.3.13 The soils and natural resources of the study area have made it attractive for human habitation for thousands of years (see Volume 5: Appendix CH-001-022). Settlement appears to have focused in the prehistoric and Roman periods around the valleys and tributaries of the rivers Trent and Tame. There is no evidence in the study area for activity dating from the Palaeolithic or Mesolithic periods, but evidence of the later prehistoric periods has been found within the study area: the Neolithic causewayed enclosure at Mavesyn Ridware (a scheduled monument) lies 1.5km from the area of land required for the Proposed Scheme, and sites with a possible Neolithic origin are found at (WHA312) and (WHA315).

6.3.14 Evidence of possibly later bronze age or iron age activity has been identified in the study area: (WHA327), an enclosure and pit alignment near Tuppenhurst Farm, enclosures or other landscape features at (WHA344) and (WHA345) near Brokendown Wood, enclosures and other features at (WHA361) near Riley Hill Farm, an enclosure on the Fulfen Brook (WHA312) and the site at the Bourne Brook (WHA324) all most likely date to this period.

6.3.15 Likely Roman sites, represented by crop marks, are located in the study area at the Mare Brook and Bourne Brook. Sites which may provide evidence of Roman activity have been identified in the study area at (WHA315), where a large area of crop marks just north of Ryknield Street (WHA328) may represent Roman settlement or at least intensive farming. (WHA324) contains features which represent a complex agricultural landscape, probably originating much earlier but possibly still occupied in the Roman period.

6.3.16 There is no evidence for early medieval settlement in the study area, in common with much of the broader region and indeed the United Kingdom as a whole, with many sites going on to be developed and occupied in later periods. By the medieval period,

settlement had become focused on centres at Lichfield, Streethay, Whittington and Handsacre. Evidence for habitation in the rural surrounds of these centres has been found in the study area in the form of recorded sites and objects. Two of these sites are scheduled monuments – medieval moated sites at Streethay (WHA132) and at Handsacre (WHA326).

6.3.17 From the early medieval period onwards, the countryside around these settlements was organised and demarcated with hedges and boundaries; some of these boundaries still survive in the form of ancient hedgerows (WHA330-334). Patches of ancient woodland also survive between and within the demarcated fields, including at Ravenshaw Wood (WHA222) and John's Gorse (WHA226). Scattered areas of ridge and furrow cultivation are seen within the study area, and while these have not been definitively dated to the medieval period, they may represent the small scale cultivation associated with dispersed settlement of the period (WHA326, WHA357 and WHA321).

6.3.18 From the 18th century onwards, Whittington Heath (WHA303) was used as a racecourse, later becoming Whittington Heath Golf Club from the latter part of the 19th century.

6.3.19 A major change in the landscape of the post medieval period was in the construction of the canals. The Trent and Mersey Canal (WHA320), or Grand Trunk Canal, was the second of this country's arterial canals, authorised in 1766.The need to link Liverpool with London led to the building of the Oxford and Coventry Canals, the Coventry Canal (WHA309) joining the Grand Trunk Canal at Fradley Junction (WHA150). The Wyrley and Essington Canal (WHA308) joined the Coventry Canal at Huddlesford Junction in the study area.

6.3.20 The most significant changes in landscape pattern of the study area in the late 19th and early 20th century were in the development of military establishments at DMS Whittington (Whittington Barracks) (WHA301) and RAF Lichfield (WHA316).

Future baseline

Construction (2017)

6.3.21 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. None of the identified developments affect the assessment of the Proposed Scheme's likely construction impacts on heritage assets.

Operation (2026)

6.3.22 No committed developments have been identified in this local area that will materially alter the baseline conditions in 2026.

6.4 Effects arising during construction

Avoidance and mitigation measures

6.4.1 The draft CoCP sets out the provisions that will be adopted to control effects on cultural heritage assets. The provisions include the following (see Volume 5: Appendix CT-003-000/1):

- management measures that will be implemented for assets that are to be retained within the land required for the construction of the Proposed Scheme (draft CoCP, Section 8);
- the preparation of project wide principles, standards and techniques for works affecting heritage assets (draft CoCP, Section 8);
- a programme of archaeological investigation and recording to be undertaken prior to/or during construction works affecting the assets (draft CoCP, Section 8); and
- a programme of historic building investigation and recording to be undertaken prior to modification or demolition of the assets (draft CoCP, Section 8).

6.4.2 The following measures have been incorporated into the design of the Proposed Scheme to reduce impacts on assets:

- alignment avoids all village centred conservation areas such as Whittington (WHA304) and Kings Bromley (WHA218);
- alignment does not have a physical impact on any listed structures or scheduled monuments;
- structures on the Coventry Canal including a listed milepost, King's Orchard Bridge and Stoney Step Bridge (WHA309) will be protected from physical impacts during temporary works;
- alignment avoids the scheduled monument and listed buildings at Streethay Manor (WHA132);
- the undesignated milepost (WHA091), an asset of low value, will be temporarily removed to facilitate realignment of the A51 Tamworth Road and construction of a new roundabout and will be reinstated as close as possible to its original position; and
- landscape design reduces impact on the setting of designated assets on the Trent and Mersey Canal (WHA340).

Assessment of impacts and effects

Temporary effects

6.4.3 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 construction of the Proposed Scheme and assets in the wider study area due to the visibility of plant, cranes and equipment; and other construction factors.

6.4.4 The following significant effects will occur as a result of temporary impact on the setting of designated or non-designated heritage assets:

- Ellfield House and Lodge (WHA018), an asset of low value, will experience temporary disruption of its historic landscape setting during earth moving for construction of the mainline adjacent to the boundary of the asset and there

will be a noise impact for approximately three years and six months. This will constitute a high adverse impact and moderate adverse effect;

- Whittington Hill House and Hill Farm (WHA022) an asset of low value, will experience temporary disruption of its historic landscape setting during earth moving for construction of the mainline less than 50m from the boundary of the asset, and there will be a noise impact for approximately three years and six months. This will constitute a high adverse impact and moderate adverse effect;
- Shaw House (WHA079), an asset of low value, will experience noise and disruption to access during construction of the scheme embankment for approximately one year and six months. This will constitute a high adverse impact and moderate adverse effect;
- Streethay Manor and moated site (WHA132), an asset of high value, will experience disruption to historic access during construction. There will be noise during earth moving for the scheme embankment for approximately six years and during the construction of the Streethay Viaduct for approximately one year. This will constitute a high adverse impact and major adverse effect;
- Ancient woodland at Big Lyntus (WHA221), an asset of high value, will have its immediate rural setting affected during construction by the presence of the Trent and Mersey Canal east viaduct (southeast) satellite compound for approximately one year and six months and a large material storage area. There will also be construction related noise within the woodland. This will constitute a low adverse impact and moderate adverse effect;
- the Coventry Canal (WHA309), an asset of moderate value, will experience disruption of its local landscape setting of the canal through the presence of extensive material storage for approximately four years, including two and years and six months for Fulfen Wood viaduct works and a further one and half years for Streethay viaduct works and changes to access to, and appreciation of, the canal's historic structures at King's Orchard Bridge, Stoney Step Bridge, and a listed milestone between the bridges. This will transform the setting of this area of the canal resulting in a medium adverse impact and moderate adverse effect;
- the Trent and Mersey Canal Bridge 53 and Wood End Lock (WHA 338), an asset of moderate value, will experience noise during construction for approximately one year and six months and loss of the ability to appreciate the canal in its historic setting. This will constitute a medium adverse impact and moderate adverse effect;
- Wood End Lock Cottage (WHA 339), an asset of moderate value, will experience noise during construction and loss of the ability to appreciate the building in its historic setting. Historic access will be disrupted by construction of a satellite compound adjacent to the asset and use of its access road for approximately one year and six months. This will constitute a high adverse impact and major adverse effect; and

- the Trent and Mersey Canal conservation area (WHA340), an asset of moderate value, will experience noise during construction and loss of the ability to appreciate the canal in its historic setting for approximately one year and six months. This will constitute a high adverse impact and major adverse effect.

Cumulative effects

6.4.5 It is not considered that there will be any cumulative effects from temporary impacts on heritage assets within the study area.

Permanent effects

6.4.6 The following significant effects will occur as a result of physical impacts on heritage assets within the land required for the construction of the Proposed Scheme:

- Hill Farm (WHA090), an asset of low value, will be demolished for construction of the Streethay sidings site. This will constitute a high adverse impact and moderate adverse effect;
- part of the ancient woodland at Ravenshaw Wood (WHA222), an asset of high value, will be removed for construction of the embankment for the main alignment. This will constitute a medium adverse impact and major adverse effect;
- the majority of ancient woodland at John's Gorse (WHA226), an asset of high value, will be removed for construction of the embankment for the main alignment. This will constitute a high adverse impact and major adverse effect;
- the historic landscape of Curborough piecemeal enclosure (WHA227), an asset of low value, will be bisected by the Proposed Scheme. Many of the historically enclosed fields will be affected by the Proposed Scheme leading to loss of fabric, coherence and legibility. This will constitute a high adverse impact and moderate adverse effect;
- Whittington Heath Golf Course clubhouse (WHA302), an asset of moderate value, will be demolished for construction of the Proposed Scheme cutting and earthworks. This will constitute a high adverse impact and major adverse effect;
- archaeological deposits related to medieval Streethay (WHA314), an asset of moderate value, will be removed for a new access for The Manor House and for temporary works around the Streethay viaduct. This will constitute a medium adverse impact and moderate adverse effect;
- archaeological deposits related to the prehistoric landscape at Mare Brook (WHA320), an asset of low value, will be removed for construction sidings. This will constitute a high adverse impact and moderate adverse effect;
- archaeological deposits related to the prehistoric landscape at Bourne Brook (WHA324), an asset of moderate value, will be removed for construction of mainline embankments, temporary workers' accommodation, materials stockpile and the A515 Lichfield Road underbridge main compound and compound access. This will constitute a medium adverse impact and moderate

adverse effect;

- archaeological deposits within relict fields at Ravenshaw Wood (WHA321), including the site at 'King's Standing', an asset of moderate heritage value, will be removed for construction of the Proposed Scheme embankment and landscaping. This will constitute a high adverse impact and major adverse effect;
- an important hedgerow along Tamworth Road (WHA330), an asset of moderate value, will be partially removed by a cutting and landscaping. This will constitute a medium adverse impact and moderate adverse effect;
- an important hedgerow along the Streethay parish boundary (WHA331), an asset of moderate value, will be partially removed by a cutting and landscaping. This will constitute a medium adverse impact and moderate adverse effect;
- an important hedgerow along Tewnals Lane (WHA334), an asset of moderate value, will be partially removed at a number of locations. This will constitute a medium adverse impact and moderate adverse effect;
- archaeological deposits in the location of a medieval moated site (WHA310), an asset of moderate value, will be removed during the topsoil strip for the Streethay sidings and storage site. This will constitute a high adverse impact and major adverse effect;
- part of Whittington Heath Golf Course (WHA303), an asset of low heritage value, will be removed. The Proposed Scheme bisects the course in steep cutting and on embankment, visually intruding on the historic landscape of the course, interrupting its quiet heathland setting and destroying its early 20th century design. This will constitute a high adverse impact and moderate adverse effect;
- the cottage called 'Rough Stockings' (WHA046), an asset of low value, will be demolished for construction of the embankments at the Mare Brook. This will constitute a high adverse impact and moderate adverse effect;
- Field Cottage, Streethay Cottage and Elverceter (WHA039), an asset of low value, will be demolished for construction of the Streethay viaduct and embankment. This will constitute a high adverse impact and moderate adverse effect;
- Hanchwood House (WHA080), an asset of low value, will be demolished for construction of the embankment at Shaw Lane. This will constitute a high adverse impact and moderate adverse effect;
- archaeological deposits in the location of Bunyan's Mill at Mill Farm (WHA306), an asset of low value, will be removed for construction of the earthworks for the Cappers Lane viaduct. This will constitute a high adverse impact and moderate adverse effect;
- archaeological deposits of probable prehistoric date in the location of cropmarks at Wood End (WHA344), an asset of low value, will be removed for

construction of embankments and landscaping. This will constitute a high adverse impact and moderate adverse effect;

- archaeological deposits of probable prehistoric date in the location of cropmarks at Brokendown Wood (WHA345), an asset of low value, will be removed for construction of embankments and landscaping. This will constitute a high adverse impact and moderate adverse effect; and
- an area of Ridge and Furrow at Marsh Farm (WHA346), an asset of low value, will be largely removed by the Proposed Scheme. This will constitute a high adverse impact and moderate adverse effect.

6.4.7 The following significant effects will occur as a result of permanent impacts on the setting of heritage assets:

- the Manor House and moated site (WHA132), an asset of high value, will be subject to a comprehensive change in setting: the Proposed Scheme will be constructed on embankment less than 100m from the asset through historically open fields. Historic views towards Rough Stockings will be dominated by the Proposed Scheme and the connection with other parts of medieval Streethay will be severed. There will be disruption to historic access. This will constitute a high adverse impact and major adverse effect;
- Ellfield House and Lodge (WHA018), an asset of low value, will be subject to a significant change in its setting: the Proposed Scheme will be in permanent view, curtailing historic views to Whittington Hill Farm and to open fields. This will constitute a high adverse impact and moderate adverse effect;
- Whittington Hill House and Hill Farm (WHA022), an asset of low value, will be subject to a significant change in its setting: the cutting for the Proposed Scheme will be less than 100m away with earthworks less than 50m away – open field views will be curtailed by earthworks and historic access will be disrupted with the realignment of Darnford Lane. Historic views to Ellfield House will be affected. This will constitute a high adverse impact and moderate adverse effect;
- ancient woodland at Slaish (WHA223), an asset of high value, will be effectively severed from its historic landscape context to the south changing its setting and affecting its significance as an element of the area's historic landscape character and form. This will constitute a low adverse impact and moderate adverse effect;
- ancient woodland at Vicar's Coppice (WHA225), an asset of high value, will be severed from its historic landscape context to the north. The existing WCML and Proposed Scheme will essentially bound the asset's setting, affecting its significance as an element of the area's historic landscape. This will constitute a low adverse impact and moderate adverse effect;
- The Trent and Mersey Canal Bridge 53 and Wood End Lock (WHA 338), an asset of moderate value, will be subject to a change in setting: the Proposed Scheme will be less than 100m away on embankment with planting between the asset and the Proposed Scheme. Effects will be visual, with historic views

from the bridge curtailed by scheme landscaping and by the Manchester spur, and the canal underbridge being constructed in full sight to the north-west. This will constitute a medium adverse impact and moderate adverse effect;

- Wood End Lock Cottage (WHA 339), an asset of moderate value, will be subject to a change in setting: the Proposed Scheme will be less than 100m away on embankment with planting between the asset and the Proposed Scheme. Effects will be visual, with historic views from the cottage curtailed by landscaping and by the Manchester spur, and the canal underbridge being constructed in full sight to the north-west. This will constitute a medium adverse impact and moderate adverse effect; and
- the Trent and Mersey Canal conservation area (WHA340), an asset of moderate value, will be subject to a change in setting: the Proposed Scheme will be less than 100m away on embankment with planting and ponds between the assets and the Proposed Scheme. Effects will be visual, with historic views from the bridge curtailed by landscaping and by the Manchester spur, and the canal under-bridge being constructed in full sight to the north-west. This will constitute a medium adverse impact and moderate adverse effect.

Permanent cumulative effects

6.4.8 There are no inter-project effects on cultural heritage.

Other mitigation measures

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

Summary of likely residual significant effects

6.4.10 The residual effects are the same as those reported above.

6.4.11 The temporary effects of construction activity on the setting of heritage assets are largely reversible in nature and last for the duration of the construction works. Residual effects will arise from the visibility of construction plant and in particular the loss of vegetation which forms part of the setting of assets. The physical impacts of construction on heritage assets are permanent and not reversible where heritage assets will be removed. There will also be a permanent residual effect on the setting of heritage assets due to the presence of the constructed Proposed Scheme.

6.4.12 A number of archaeological assets will be permanently lost due to the construction of the Proposed Scheme; these include several prehistoric sites including areas of remains at Mare Brook, Bourne Brook, Brokendown Wood and Wood End; archaeological remains from the medieval period at Streethay, Bunyan's Mill and

Ravenshaw Wood; and areas of ridge and furrow. A programme of archaeological works will be prepared to investigate, analyse, report and archive these assets.

6.4.13 The Proposed Scheme will result in the demolition of a number of built heritage assets including Hill Farm at Streethay, Whittington Heath Golf Course clubhouse, Rough Stockings, Hanchwood House, Field Cottage, Streethay Cottage and Elverceter. A programme of built heritage works will be prepared to investigate, analyse, report and archive these assets.

6.4.14 The Proposed Scheme will sever elements of the historic landscape, including lengths of important hedgerow and areas of ancient woodland at Ravenshaw Wood and John's Gorse. The Proposed Scheme will also physically affect the historic piecemeal enclosure landscape at Curborough and the Whittington Heath Golf Club. In addition, elements of the Proposed Scheme such as cuttings and embankments will affect the setting of historic settlements and buildings such as the scheduled and listed Streethay Manor House and moated site, the Trent and Mersey Canal conservation area and associated listed buildings, and several non-designated buildings and groups of buildings. Further consideration will be given to the historic vegetation and landscapes as part of the planting and landscape design plans that will be further prepared for HS2.

6.5 Effects arising from operation

Avoidance and mitigation measures

6.5.1 The following measures have been incorporated into the design of the Proposed Scheme to reduce the impacts and effects on assets:

- noise mitigation measures have been included within the scheme design to reduce potential impacts on identified assets; and
- landscape planting will increasingly reduce impacts on the setting of the designated assets within the study area as it matures during the operational phase.

Assessment of impacts and effects

6.5.2 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 the setting of heritage assets arising from the physical presence of the Proposed Scheme are described as permanent occurring within the construction phase and are not repeated in detail here, although they will endure through the operation of the Proposed Scheme. Where there is a combined effect on the setting of an asset from the presence of the constructed scheme and its operation, this is reported in the assessment of operation.

6.5.3 Significant environmental effects will occur as a result of permanent changes to the setting of the following assets arising from the impacts of railway operation.

- Ellfield House and Lodge (WHA018), an asset of low value, will be less than 50m from the Proposed Scheme. While trains will be in cutting, there will be an increase in noise of more than 10dB (Volume 5: Map Book — sound, noise and

vibration, Map SV-02-62). This will result in a high adverse impact as the asset's current quiet rural setting contributes to its significance. There will also be high adverse permanent construction impact as a result of changes to the setting of the asset. The combined presence and operation of the Proposed Scheme will adversely alter the significance of the setting of this asset, resulting in a high adverse impact and moderate adverse effect;

- Whittington Hill House and Hill Farm (WHA022), an asset of low value, is less than 500m from the Proposed Scheme. While trains will be in cutting, there will be an increase in noise of more than 10dB (Volume 5: Map Book — sound, noise and vibration, Map SV-02-62). This will result in a high adverse impact as the asset's current quiet rural setting contributes to its significance. There will also be high adverse permanent construction impact as a result of changes to the physical setting of the asset. The combined presence and operation of the Proposed Scheme will adversely alter the significance of the setting of this asset, resulting in a high adverse impact and moderate adverse effect;

- Ancient woodland at Slaish (WHA223), an asset of high value, will have its rural character affected by an increase in noise which will be audible from within the wood (Volume 5: Map Book — sound, noise and vibration, Map SV-01-64). This will result in a low adverse impact. There will also be low adverse permanent construction impact. The combined presence and operation of the Proposed Scheme will result in a low adverse impact and moderate adverse effect;

- Ancient woodland at Vicar's Coppice (WHA225), an asset of high value, will have its rural character affected by an increase in noise which will be audible from within the wood (Volume 5: Map Book — sound, noise and vibration, Map SV-01-64). This will result in a low adverse impact. There will also be low adverse permanent construction impact. The combined presence and operation of the Proposed Scheme will result in a low adverse impact and moderate adverse effect;

- Ancient woodland at John's Gorse (WHA226), an asset of high value, will have its rural character affected bya significant increase in noise which will be audible from within the wood (Volume 5: Map Book — sound, noise and vibration, Map SV-01-64). This will result in a medium adverse impact. There will also be high adverse permanent construction impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and major adverse effect;

- Whittington Heath Golf Course (WHA303), an asset of low value, will be subject to an increase in noise audible across the golf course (Volume 5: Map Book — sound, noise and vibration, Map SV-01-61/2). This will result in a medium adverse impact. There will also be high adverse permanent construction impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and moderate adverse effect;

- Trent and Mersey Canal – Bridge 53 and Wood End Lock (WHA338), a Grade II listed asset of moderate value, will be subject to an increase in noise (Volume 5: Map Book — sound, noise and vibration, Map SV-01-64) affecting the asset's rural setting, and there will be views of the trains. This will result in a medium

adverse impact. There will also be a medium adverse permanent construction impact as a result of changes to the setting of the asset. The combined presence and operation of the Proposed Scheme will adversely alter the significance of the setting of this asset, resulting in a medium adverse impact and moderate adverse effect;

- Trent and Mersey Canal – Wood End Lock Cottage (WHA339), a Grade II listed asset of moderate value, will be subject to an increase in noise (Volume 5: Map Book — sound, noise and vibration, Map SV-02-64) affecting the asset's rural setting, and there will be views of the trains. This will result in a medium adverse impact. There will also be a medium adverse permanent construction impact as a result of changes to the setting of the asset. The combined presence and operation of the Proposed Scheme will adversely alter the significance of the setting of this asset, resulting in a medium adverse impact and moderate adverse effect;
- the Trent and Mersey Canal conservation area (WHA340) an asset of moderate value, will be subject to an increase in noise (Volume 5: Map Book — sound, noise and vibration, Map SV-01-64) affecting the asset's rural setting, and there will be views of the trains. This will result in a medium adverse impact. There will also be a medium adverse permanent construction impact as a result of changes to the setting of the asset. The combined presence and operation of the Proposed Scheme will adversely alter the significance of the setting of this asset, resulting in a medium adverse impact and moderate adverse effect;
- the historic piecemeal enclosure landscape at Curborough (WHA227), an asset of low value, will be subject to increases in noise (Volume 5: Map Book — Sound, noise and vibration, Map SV-01-61) which will affect the asset's rural character and setting. This will result in a low adverse impact. There will also be high adverse permanent construction impact. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and moderate adverse effect;
- Streethay Manor and moated site (WHA132), an asset of high value, will be subject to a considerable change in noise levels (Volume 5: Map Book — Sound, noise and vibration, Map SV-02-62) and trains will be visible on the elevated embankments and viaducts. This will affect the general rural setting of the asset but its overall impact on setting and significance is lessened by the fact that the asset lies close to a major road, consequently noise is already a factor in its setting. The operation of the Proposed Scheme will therefore result in a low adverse impact. There will also be high adverse permanent construction impact as a result of changes to the setting of the asset. The combined presence and operation of the Proposed Scheme will adversely alter the significance of the setting of this asset resulting in a high adverse impact and major adverse effect; and
- ancient woodland at Ravenshaw Wood (WHA222), an asset of high value, will be subject to an increase in noise detracting from its quiet character and the setting of the remaining woodland (Volume 5: Map Book — sound, noise and

vibration, Map SV-02-64). This will result in a medium adverse impact. There will also be medium adverse permanent construction impact as a result of changes to the setting of the asset and to the asset itself. The combined presence and operation of the Proposed Scheme will result in a high adverse impact and major adverse effect.

Cumulative effects

6.5.4 During the operational phase of the Proposed Scheme, cumulative development projects described in Section 2.1 and Volume 5: Appendix CT-004-000 include construction of HS2 Phase Two. Assessment of inter-project effects on cultural heritage assets arising from the interaction of the Proposed Scheme with cumulative development projects has been undertaken. No significant cumulative effects have been identified in relation to cultural heritage.

Other mitigation measures

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

Summary of likely residual significant effects

6.5.6 The setting of several historic settlements, buildings and landscapes will be affected visually and by noise once the Proposed Scheme becomes operational. This includes the scheduled and listed Streethay Manor, the Trent and Mersey Canal conservation area and associated listed buildings, areas of ancient woodland and non-designated buildings, groups of buildings and areas of historic landscape. In due course some visual effects will reduce as planting matures and the new railway assimilates into the landscape.

7 Ecology

7.1 Introduction

7.1.1 This section describes the ecological baseline and identifies likely impacts and significant ecological effects that will arise from the construction and operation of the Proposed Scheme. These include impacts on species, habitats and sites designated for their importance for nature conservation.

7.1.2 The principal ecological issues in this area are: loss of habitat where the route of the Proposed Scheme passes through John's Gorse Site of Biological Importance (SBI) and ancient woodland; Whittington Heath Golf Course SBI; Ravenshaw Wood, Black Slough and Slaish SBI (part of which is ancient woodland); Vicar's Coppice Biodiversity Alert Site (BAS) and ancient woodland; and impacts on bats using the Trent and Mersey Canal and associated woodland.

7.1.3 Volume 5 of the ES contains supporting information to the ecological assessment reported in this section, including:

- results of ecological surveys (Volume 5: Appendix EC-001-003, EC-002-003, EC-003-003 and EC-004-003); and
- register of local/parish effects which are not described individually in Volume 2 (Volume 5: Appendix EC-005-003).

7.1.4 As well as survey data, the assessment draws on existing information gathered from national organisations and from regional and local sources including: Staffordshire Wildlife Trust; the Environment Agency; and Staffordshire Ecological Record.

7.2 Scope, assumptions and limitations

7.2.1 The scope and methodology of the ecological assessment are introduced in the SMR (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2). Further detail, including the study area for individual surveys, is provided within the SMR Addendum. The assessment methodology is summarised in Section 8 of Volume 1 of the ES, along with route-wide assumptions and limitations. Limitations associated with particular surveys are reported in Volume 5: Appendices EC-001-003, EC-002-003, EC-003-003 and EC-004-003.

7.2.2 A Water Framework Directive assessment has been undertaken in conjunction with the environmental assessment. Details of this assessment are presented in Volume 5: Appendix WR-001-000.

7.2.3 Access was not obtained to all of the land area where general habitat survey (Phase 1 habitat survey) was proposed. Locations with the potential to support key ecological receptors where access could not be gained for survey include Vicar's Coppice, Fulfen Wood, Harvey's Rough, Tuppenhurst Lane (west of) SBI and the Mare Brook. There was lack of access to some ponds for amphibian surveys; and the Wyrley and Essington Canal, an unnamed tributary of the Fisherwick Brook and an unnamed tributary of the Mare Brook were only partially accessible. Further details are provided in Volume 5: Appendices EC-001-003, EC-002-003, EC-003-003, and EC-004-003.

7.2.4 Where data are limited, a precautionary baseline has been built up according to the guidance provided in the SMR Addendum (Volume 5: Appendix CT-001-000/2). This constitutes a 'reasonable worst case' basis for the subsequent assessment.

7.2.5 The precautionary approach to the assessment that has been adopted identifies the likely significant ecological effects of the Proposed Scheme.

7.3 Environmental baseline

Existing baseline

7.3.1 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 and maps presented in Volume 5: Appendix EC-001-003 to EC-004-003 and Volume 5: Map Book – Ecology, Maps EC-01 to EC-12. Statutory and non-statutory designated sites are shown on Volume 5: Map Book – Ecology, Maps EC-01 to EC-12.

7.3.2 Land required for the construction of the Proposed Scheme and that adjacent to it consists mainly of arable land, bounded by open hedgerows and tree lines. Lichfield is a major settlement to the west of the Proposed Scheme, but along the length of the route, the area is relatively sparsely populated with the main development areas being the villages of Whittington Heath, Huddlesford and Streethay. There is a concentration of ancient woodland in the northern part of the area, whilst broadleaved semi-natural woodland and improved grassland make up the majority of the remaining land use types. The Trent and Mersey Canal, the Wyrley and Essington Canal, Curborough Brook and Bourne Brook are all crossed by the route of the Proposed Scheme.

Designated sites

7.3.3 There are no statutory designated sites located within 500m of the land required for the construction of the Proposed Scheme.

7.3.4 There are 11 LWS relevant to the assessment in this area; each is of county/metropolitan value. They are:

- Whittington Heath Golf Course SBI – formerly a single block of heathland known as Whittington Heath. Much of the unmanaged areas of the site support immature woodland of common oak or mixed oak/silver birch with some developing understorey of holly and rowan, along with bracken. There are some patches dominated by heather but much of the site is a mosaic of remnant heath, with heather dominating only in the less managed areas. Damp acid and drier acid grassland patches are also present and the site supports breeding birds and terrestrial invertebrates. The SBI is partially within the land required for the construction of the Proposed Scheme;
- Curborough House Hedgerows SBI – consists of Curborough House (hedge 1) and Curborough House (hedge 4). Both hedges are valued for the high number of woody species and standard trees along their length; mature pedunculate oak standards up to 20m being noted approximately every 50m. The northern section of the SBI lies within the area required for the construction of the Proposed Scheme;

- Big Lyntus SBI – the woodland mainly comprises mixed plantation trees with a small area of broadleaved woodland. The northern part of the woodland is replanted ancient woodland with a high canopy (up to 30m) dominated by semi-mature beech and Scots pine trees. Ground flora is limited to the edges of the woodland or patches where there are gaps in the canopy, where bluebell, wood sage, greater stitchwort and yellow archangel are present, with common nettle and cleavers being frequent species. The SBI is located adjacent to the land required for the construction of the Proposed Scheme off Wood End Lane;

- Fradley Wood BAS – this includes Fradley Gorse, Brokendown Wood and secondary woodland adjacent to the banks of the Trent and Mersey Canal. The site is made up of blocks of both coniferous and broadleaved plantation. Large areas of woodland from within the BAS have been felled and the land returned to agriculture. The BAS lies partially within the land required for the construction of the Proposed Scheme (Manchester spur);

- Wood End Lock (south-east of) SBI – is a small deciduous wood, beside the Trent and Mersey Canal, that is bordered by Curborough Brook and containing a steep-sided pond. The woodland canopy comprises mature common oak with alders abundant near the pond and on the brook margins. There is a well-developed shrub layer and a number of plants (yellow archangel, bluebell, dog's mercury) indicative of ancient woodland. This site lies adjacent to land required for the construction of the Proposed Scheme;

- Trent and Mersey Canal and Coventry Canal, Kings Bromley Wharf to Fradley Junction and from Fradley Junction to Fradley Bridge SBI – comprises two lengths of canal. Generally both canals support a similar range of emergent species, although the amount of marginal vegetation differs from place to place. It is usually comprised of reed sweet-grass, branched bur-reed and sweet-flag. Additional species occur at various localities, including some such as flowering rush, arrowhead and greater tussock-sedge which are rare or uncommon in the county. The diverse marginal and emergent vegetation supports a range of invertebrates including butterflies, dragonflies and damselflies. The SBI is crossed by the route of the Proposed Scheme;

- Ravenshaw Wood, Black Slough and Slaish SBI – is adjacent to the Trent and Mersey Canal, and consists of three contiguous woodlands: Ravenshaw Wood, Black Slough and the Slaish. Part of the SBI is ancient semi-natural woodland and part ancient replanted woodland with even aged canopy of pedunculate oak. The sites are locally waterlogged and soils noticeably acidic, with the vegetation communities being typical for these soil conditions. Rhododendron is established in the woodland and, in the southern and more eastern parts, now forms a dense understorey. In the remainder of the site, the ground layer comprises areas dominated by bramble or by bracken, with some localised patches of wavy hair-grass on the most acidic soils. Accompanying species include broad buckler fern, wood sage and bluebell all of which are confined to the most westerly block where honeysuckle is also most abundant. The SBI is within the land required for the construction of the Proposed Scheme;

- Vicar's Coppice BAS – lies adjacent to the A515 (Lichfield Road) and consists of 7ha of ancient semi-natural broadleaved woodland, the canopy dominated by common oak with some birch. However, the ground flora has become degraded through its use as a venue for paintballing and the remaining scrub layer is dominated by rhododendron. The BAS is partially within the land required for the construction of the Proposed Scheme;
- John's Gorse SBI – consists of two areas of ancient and semi-natural broadleaved woodland, with canopy species of sycamore, hazel, rowan, elder, birch and alder. The more northerly woodland block is heavily grazed with the southern block fenced off and less affected by cattle. The SBI is located entirely within the land required for the construction of the Proposed Scheme;
- Tuppenhurst Lane (west of) SBI – supports a range of habitats that are uncommon in the Lichfield District area, including marshy grassland, unimproved grassland and swamp, and is dissected by a narrow stream which joins a tributary of the River Trent. The wooded canopy adjacent to the stream is dominated by alder with hawthorn, grey willow and goat willow. This SBI lies partly within the land required for the construction of the Proposed Scheme; and
- Tomhay Wood SBI – lying between Wood End Lane and the West Coast Main Line (WCML). The site consists of a remnant area of ancient woodland with some planted areas of larch, spruce and the non-native species Turkey oak. The wood is in a degraded state with rhododendron, Himalayan balsam and bracken becoming dominant in places. The SBI lies immediately adjacent to the land required for the construction of the Proposed Scheme.

7.3.5 In additional to the areas of ancient woodland which fall within designated sites, one area of ancient woodland occurs within the extent of or adjacent to the Proposed Scheme: Hanchwood House Wood. The site is adjacent to John's Gorse SBI, is similar in its composition and was originally part of the SBI designation. However, its inclusion in the SBI designation appears to have been rescinded when the Staffordshire Ecological Record unit resurveyed John's Gorse in 2011. Ancient woodlands represent an irreplaceable resource.

Habitats

7.3.6 The following habitat types which occur in this area are relevant to the assessment.

Woodland

7.3.7 Within Big Lyntus woodland the northern part of the site is ancient replanted woodland with a high canopy (up to 30m) dominated by semi-mature beech and Scots pine trees. A National Vegetation Classification (NVC)[20] survey identified the beech woodland community W15 *Fagus sylvatica-Deschampsia flexuosa* woodland which is lowland mixed deciduous woodland, a habitat of principal importance, and identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[21]. Between the northern part of the woodland and a strip of semi-natural woodland on

[20] NVC is a detailed survey and classification system that is used to compare plant communities with a range of defined community types.
[21] *Natural Environment and Rural Communities Act 2006 (Chapter 16).* Her Majesty's Stationery Office, London.

the southern boundary of the site is a more recent plantation dominated by pedunculate oak with occasional ash. The strip of ancient semi-natural woodland in the south of the site is structurally and botanically more diverse than the plantation areas. This woodland is of county/metropolitan value.

7.3.8 NVC surveys identified most of Ravenshaw Wood as the oak woodland community W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, characteristic of woods on base poor soils and widespread over the lowlands of England and Wales. The area in the north-west of the woodland is on waterlogged ground and has a birch community identified as W4 *Betula pubescens-Molinia caerulea* woodland. The majority of Black Slough is similar to Ravenshaw Wood. Further north, towards the Trent and Mersey Canal, the area of woodland known as the Slaish has very wet ground conditions and the canopy changes to a low shrub layer of grey willow with scattered crack willow. Alder is present alongside the canal. Rhododendron is also present. There are small pools and raised areas forming a mosaic of wet and drier conditions with stands of tall herbaceous plants such as yellow iris, lesser pond-sedge and soft rush. The most noticeable characteristic of this habitat are cushions of bog mosses. These woodland habitats together are of county/metropolitan value.

7.3.9 Vicar's Coppice is ancient woodland and lowland mixed deciduous woodland habitat of principal importance. Although access was not available for survey, details from the citation for Vicar's Coppice BAS indicate that the woodland is unmanaged and degrading. However, using a precautionary approach the woodland is considered to be of up to county/metropolitan value.

7.3.10 Tomhay Wood is an area of remnant ancient woodland. Access was not available for survey; therefore, taking a precautionary approach the woodland is assumed to be of county/metropolitan value.

7.3.11 John's Gorse is split into two main areas which are heavily grazed. The canopy of the northern area (John's Gorse) consists mainly of oak and some birch, now dying back, above a grassy field layer. The very sparse understorey contains hawthorn, holly and sweet chestnut. Fox Covert, the southern section of the John's Gorse, appears to have once been much larger and has been reduced by felling and wayleave maintenance to accommodate an overhead power line. This woodland has been extensively planted with conifers, including Norway spruce, Scots pine and common larch. The canopy is open with relatively few mature broadleaved trees. Cherry and birch are present, but more than half the area consists of hawthorn and elder scrub, with some hazel. Hanchwood House Wood, a remnant of former ancient woodland which is present on the 1884 OS map, is lowland mixed deciduous woodland which is a habitat of principal importance. Access to the area was not obtained. These woodlands are fragmented and show no evidence of traditional management such as coppicing. Due to the proximity of these woodlands, which were like to be contiguous in the past, they are evaluated collectively as being of up to county/metropolitan value.

7.3.12 Fradley Wood was not surveyed in its entirety due to access restrictions. A NVC survey was carried out within the compartment of Fradley Wood known as Fradley Gorse, adjacent to the eastern bank of the Trent and Mersey Canal. This survey identified the oak woodland community W10 *Quercus robur-Pteridium aquilinum-Rubus fruticosus* woodland, a habitat of principal importance. The woodland sub-community identified

(W10d) is typical of disturbed and secondary woodlands. The woodland is of district/borough value.

7.3.13 Brokendown Wood, which is part of Fradley Wood BAS, was not accessible for survey but appears to be broadleaved plantation adjacent to the Trent and Mersey Canal and is likely to support lowland mixed deciduous woodland, a habitat of principal importance. The woodland is assumed to have district/borough value.

7.3.14 The woodland near Wood End Lock (within Wood End Lock (south-east of) SBI) contains wet woodland, a habitat of principal importance, dominated by alder and ash surrounding a pond. Wetter depressions to the north-west of the pond contain crack willow up to 10m in height and large bitter-cress, which is locally abundant with ground ivy. NVC survey identified the alder woodland community W6 *Alnus glutinosa-Urtica dioica* woodland. The remaining woodland is drier and was identified as the ash woodland community W8 *Fraxinus excelsior-Acer campestre-Mercurialis perennis* woodland, a habitat of principal importance (lowland mixed deciduous woodland). This woodland is of district/borough value.

7.3.15 A block of secondary woodland to the south of John's Gorse and Hanchwood House Wood, alongside Bourne Brook, is wet woodland, a habitat of principal importance. It has a canopy of alder and predominantly even-aged pedunculate oak with some conifers (probably planted approximately 50 to 60 years ago). The woodland is subject to seasonal flooding and is most closely resembles the alder woodland community W6 *Alnus glutinosa-Urtica dioica with a sub-community* which is a widespread but localised community, found on damp and periodically flooded sites. A single veteran field maple is present at the northern tip of the site, adjacent to a pond. This woodland lies immediately adjacent to the land required for the construction of the Proposed Scheme and is of local/parish value.

7.3.16 There are areas of lowland mixed deciduous woodland within or immediately adjacent to the Proposed Scheme at Fulfen Wood, DMS Whittington, Harvey's Rough and Little Lyntus. These small areas of woodland were not surveyed due to access restrictions but they are likely to support lowland mixed deciduous woodland, habitat of principal importance. It is considered that each is of up to local/parish value.

Hedgerows

7.3.17 There are four hedgerows partly within the land required for construction of the Proposed Scheme which meet the wildlife and landscape criteria under the Hedgerows Regulations 1997[22]. There are also four species-rich hedgerows within the land required for construction of the Proposed Scheme. These hedgerows qualify as a habitat of principal importance.

7.3.18 Two of the hedgerows which meet the wildlife and landscape criteria under the Hedgerow Regulations 1997 (i.e. important hedgerows) make up Curborough House Hedgerow SBI (hedge 1 and hedge 4) (Volume 5: Map Book – Ecology, Map EC-10-127, G9 and Map EC-10-128, F9). These hedgerows are of county/metropolitan value.

[22] *The Hedgerows Regulations 1997* (1997 No. 1160), Her Majesty's Stationery Office, London.

7.3.19 The other two important hedgerows are east of Woodend Cottage, near Fradley Junction (Volume 5: Map Book – Ecology, Map EC-10-128, I6 and J7), and are of district/borough value.

7.3.20 The remaining hedgerows surveyed and assessed are generally dense with few gaps, although they are very species poor, with few mature trees. Most are dominated by common hawthorn, with some blackthorn and beech; these hedgerows each have local/parish value. However, due to the wildlife corridors created by hedgerows, the hedgerow network within the land required for construction of the Proposed Scheme is considered to be of district/borough value.

Watercourses

7.3.21 The following watercourses will be crossed by the route of the Proposed Scheme: Wyrley and Essington Canal (under restoration); Trent and Mersey Canal; Mare Brook (tributary of the River Tame) and two unnamed tributaries of the Mare Brook; an unnamed tributary of Fisherwick Brook; Curborough Brook, and Bourne Brook. The Coventry Canal is adjacent to the land required for construction of the Proposed Scheme (for the Streethay construction sidings).

7.3.22 The Trent and Mersey Canal, the Wyrley and Essington Canal and the Coventry Canal are all heavily engineered with artificial banks. NVC surveys on the Trent and Mersey Canal recorded the mire community M27 *Filipendula ulmaria-Angelica sylvestris* mire. However, most of the canal supports only commonly occurring aquatic plants which occur sporadically along the watercourse including the non-native plant monkeyflower. The Wyrley and Essington Canal and Coventry Canal support commonly occurring aquatic plants and have poor habitat availability for fish as a result of a limited range of aquatic habitats. The Proposed Scheme crossing point of the Wyrley and Essington Canal is coincident with an in-filled part of the canal (under restoration). All these canals support eutrophic standing water, at least along some of their length, which is a habitat of principal importance declining at a national level. They also provide wildlife corridors through the landscape and are considered, in each case, to be of district/borough value.

7.3.23 The Bourne Brook has engineered sections with a weir present, although the channel has sinuous sections supporting a diverse range of in-channel habitats. Common aquatic plants are present in unshaded sections and the channel has the potential to support spawning coarse and salmonid fish. The complex nature of the river corridor provides a wildlife corridor within a predominantly agricultural setting. This watercourse is of district/borough value.

7.3.24 The Curborough Brook is severely modified due to over deepening with a straightened channel and evidence of desilting works. Aquatic plants noted during surveys were limited to the west bank, which was unaffected by desilting. Some good in-channel habitats dominated by gravel are present which provide habitat for spawning fish. The watercourse also provides a wildlife corridor and is of local/parish value.

7.3.25 The unnamed tributary watercourse of Mare Brook near Fradley Business Park is severely modified by engineering, oil pollution was observed during surveys and the watercourse has poor fish habitat quality on account of high silt levels. However the watercourse channel supports a range of habitats and is of local/parish value.

7.3.26 No survey data is available for the other watercourses due to access restrictions. From a review of maps and aerial photography the unnamed tributary of the Fisherwick Brook has a highly modified, straightened channel with limited habitat variability. Although obviously modified, the second unnamed tributary watercourse of the Mare Brook does have some varied channel habitat, although it is straightened throughout much of its length. The Mare Brook has a sinuous channel in the vicinity of the Proposed Scheme crossing point and is likely to support a variety of in-channel habitat features. Each of these watercourses provides wildlife corridors through the landscape and is each considered to be of local/parish value.

Water bodies

7.3.27 There are 43 ponds within the land required for the construction of the Proposed Scheme, mostly near Streethay, Fradley Business Park and adjacent to Fradley Wood. Of these, 22 have been surveyed for amphibians and two have had detailed habitat surveys. The two ponds which have had detailed habitat surveys, have poor species diversity but provide a habitat resource in an otherwise arable landscape. Other ponds include garden ponds which are often ornamental and surrounded by amenity grassland, field ponds with shallow margins and woodland ponds, the most notable of which is within Wood End Lock (south-east of) SBI. These ponds individually are of local/parish value.

7.3.28 As a precautionary assessment, those ponds that have not been surveyed due to access restrictions, are assumed to have up to district/borough value.

Grassland

7.3.29 Tuppenhurst Lane (west of) SBI contains wet areas with marshy grassland, swamp and unimproved grassland communities. These habitats were not surveyed due to access restrictions. However, these habitat types are within an SBI and are therefore assumed to be of county/metropolitan value.

7.3.30 Of the remaining small areas of improved and semi-improved grassland that were surveyed, none were found to be notable and these habitats are of up to local/parish value.

Heathland

7.3.31 The heathland within Whittington Heath Golf Course SBI was formerly a single block of heathland known as Whittington Heath. NVC surveys identified a range of communities, from purely open communities that require regular cutting through to unmanaged woodland. There is further variation due to slight changes in moisture content of the soil caused by position and aspect. Some patches of pure heath vegetation are present, identified as the heath community H9 *Calluna vulgaris-Deschampsia flexuosa* heath, as are patches and strips of dry and damp acid grassland, in particular at the edges of the fairways (the 'rough'), below the trees and in clearings. This damp acid grassland community was identified as U4 *Festuca ovina-Agrostis capillaris-Galium saxatile* grassland. Much of the unmanaged areas of the site support immature woodland of pedunculate oak, with silver birch only occasionally recorded which is recognised as lowland deciduous woodland on the Natural England inventory of habitats of principal importance. The mosaic of habitats, including heathland, within Whittington Heath Golf Course is of county/metropolitan value.

Other habitats

7.3.32 Scrub is found mostly around field edges, damp ditches and ponds. These features individually are of up to local/parish value.

7.3.33 Arable land is found across the study area and in the wider countryside. The Phase 1 habitat data from aerial photography and surveys show that the area is dominated by arable fields with occasional hedgerows and trees. The arable land largely comprises heavily managed large fields with few features of interest to wildlife. In general, this habitat is considered to have negligible nature conservation value.

Protected and/or notable species

7.3.34 A summary of the species relevant to the assessment is provided in Table 14.

Table 14: Protected and/or notable species

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Bats	Up to regional	Population of Daubenton's bat using a roost at a residential building, east of Ravenshaw Wood, adjacent to the Trent and Mersey Canal	Possible small maternity roost with a peak emergence count of eight individuals. High levels of activity recorded during surveys along the corridor of the Trent and Mersey Canal. Daubenton's is a 'rarer'[23] bat species within England based on distribution and population size.
	County/ metropolitan	Assemblage of bats using Trent and Mersey Canal and adjacent woodlands (Ravenshaw Wood, Black Slough, the Slaish and Fradley Wood)	Moderate to high levels of activity and a diverse assemblage of bat species including: common pipistrelle, soprano pipistrelle, brown long-eared, Daubenton's, Natterer's, Leisler's, noctule and Nathusuius' pipistrelle. A low number of calls of serotine were recorded during static surveys. Bat activity was primarily associated with the woodland edges (where the woodland meets pasture), interlinking hedgerows between woodland, and along the route of the canal. Ravenshaw Wood and Black Slough supports known summer (non breeding) tree roosts for noctule with a peak count of one observed during tree climbing surveys. Within Black Slough is a known summer (non breeding) tree roost for soprano pipistrelle, with a peak re-entry count of one observed during backtracking surveys. A further three tree roosts at Ravenshaw Wood and Black Slough were identified through a small number of droppings only and may support individuals of rarer bat species, which have been confirmed using adjacent habitats. A high density of trees with high and moderate potential to support roosting bats was found within Ravenshaw Wood, Black Slough and the Slaish. Noctule, Daubenton's, Natterer's, Leisler's and Nathusuius' pipistrelle are 'rarer' bats within England. Soprano pipistrelle, noctule and brown long-eared bat are species of principal importance

[23] Numbers of bats between 10,000 and 100,000 individuals based on Wray S, Wells D, Long E and Mitchell-Jones T. (2010) Valuing bats in ecological impact assessment. In Practice. December 2010. P23-25.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
			identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[24].
	District/borough	Assemblage of bats using commuting and foraging habitats adjacent to Fradley Business Park, west of Wood End Lane	Survey found moderate levels of activity of commoner bat species including common pipistrelle, soprano pipistrelle, brown long-eared and noctule. Calls by Leisler's were recorded during static surveys. The habitats support a particularly high level of activity by noctule. Foraging activity was concentrated close to small fragments of woodland, watercourses and small water bodies. A summer (non-breeding) roost, probably used by males and/or non-breeding females with a peak emergence count of six individuals for common pipistrelle, one brown long-eared and two soprano pipistrelle was found at a residential house, near Streethay. It is likely that foraging habitats adjacent to Fradley Business Park will support bats using this roost due to the proximity of the roost. A low density of trees with moderate potential to support roosting bats is present along hedgerows.
	District/borough	Assemblage of bats using commuting habitats along the Wyrley and Essington canal	Survey found low levels of activity of commoner bat species including common pipistrelle, soprano pipistrelle and brown long-eared. A low number of calls by Leisler's and noctule were recorded each month during static surveys.
	District/borough	Assemblage of bats using habitats fronting Shaw Lane and Tuppenhurst Lane including Bourne Brook, John's Gorse and Harvey's Rough	A diverse assemblage of bats including: common pipistrelle, soprano pipistrelle, brown long-eared bats, *Myotis* species, noctule, Nathusuius' pipistrelle recorded foraging and commuting along Bourne Brook, woodland habitat and interconnecting hedgerows. Noctule bat was recorded in relatively low numbers during transect and static surveys particularly associated with woodland habitat. A very small number of passes by Nathusuius' pipistrelle, a rarer bat species, were recorded during static surveys indicative of passage or transient use rather than core foraging or commuting habitat for this species. Low levels of Leisler's and serotine were recorded during static surveys indicative of passage or transient use rather than core foraging or commuting habitat for this species. A residential building within land required for the construction of the Proposed Scheme was found to support a transient summer (non-breeding) roost probably used by males and/or non-breeding females with a peak emergence count of one and two individuals for common pipistrelle and brown long eared.

[24] *Natural Environment and Rural Communities Act 2006* (Chapter 16). Her Majesty's Stationery Office (2006).

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
			One barn and one converted barn along Shaw Lane within 100m of land required for the construction of the Proposed Scheme were found to support transient summer (non-breeding) roosts probably used by males and/or non-breeding females with a peak emergence/re-entry count of two individuals for common pipistrelle. A moderate density of trees with moderate and high potential to support roosting bats were recorded in hedgerows and within woodland habitat associated with Bourne Brook and Harvey's Rough.
	District/borough	Assemblage of bats using Whittington Heath Golf Course SBI and buildings south of Darnford Lane	A diverse assemblage of bats including: common pipistrelle, soprano pipistrelle, brown long-eared bats, *Myotis* sp. and noctule. Nathusuius' pipistrelle, a rarer bat species, was recorded during static surveys indicative of passage or transient use rather than core foraging or commuting habitat for this species. Low levels of Leisler's and serotine were recorded during static surveys indicative of passage or transient use. A low density of trees with moderate potential to support roosting bats is present. One residential building south of Darnford Lane was found to support a brown long-eared summer, transient, non-breeding roost, with a peak emergence count of one. A second building was found to support a common pipistrelle summer (non-breeding) roost probably used by males and/or non-breeding females with a peak emergence count of two individual common pipistrelle. It is considered likely that habitats within Whittington Heath Golf Course support bats using these building roosts.
	Local/parish	Bat assemblage using habitats associated with Fulfen Wood, Coventry Canal and Watery Bridge	Surveys found overall low levels of activity by common pipistrelle and soprano pipistrelle, both of these are commoner species. Individual passes by noctule, Leisler's, serotine, and *Myotis* species were also recorded occasionally throughout the survey period; indicative of passage or transient use rather than core foraging or commuting habitat for these species, which are rarer within the UK.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Assemblage of bats using habitats associated with the urban and arable habitats south-east of Handsacre between Lichfield Road and Tuppenhurst Road	Survey found low levels of activity of common and soprano pipistrelle and *Myotis* species associated with arable field boundaries. Individual passes by noctule, Leisler's and serotine were recorded occasionally during static surveys indicative of passage or transient use rather than core foraging or commuting habitat for these species. A brown long-eared building summer (non-breeding) roost was found at a residential building along the outskirts of Handsacre, probably used by males and/or non-breeding females with a peak emergence of one. Brown long eared droppings (100+ droppings) were identified during inspection survey. A number of residential buildings associated with Handsacre were found to have moderate potential to support roosting bats but no evidence of a roost was found.
Amphibians	County/ metropolitan	Assumed great crested newt metapopulation[25] AMP29 south-west of Fradley	Metapopulation AMP29 has a total of 12 water bodies, eight of which have been surveyed (four complete and four incomplete). This metapopulation has a medium population size class of great crested newts. This metapopulation also supports other amphibians (smooth newt, common frog and common toad). This metapopulation lies partially within the land required for construction of the Proposed Scheme. Given the records provided from Staffordshire Ecological Record, great crested newts appear to be abundant within Staffordshire and, given the results collated to date for CFA22, it is likely that great crested newts are widespread within the area. In alignment with the Staffordshire LWS selection criteria[26], met populations that support a medium population of great crested newts are of county/metropolitan value. Great crested newt and common toad are species of principal importance.
	County/ metropolitan	AMP30 at Fradley Wood	AMP30 has a total of eight water bodies, six of which have been surveyed (three complete and three incomplete) and two have received a HSI survey only. This metapopulation has a medium population size class of great crested newts. This metapopulation also supports other amphibian species (smooth newt, common frog and common toad). This metapopulation lies outside of the land required for construction of the Proposed Scheme.

[25] A great crested newt metapopulation is a group of associated populations made up from newts which both breed in the ponds and live in the terrestrial habitat around a cluster of ponds. The newts are likely to return to the same pond each year; however, there may be some interchange of newts between the ponds within the metapopulation. Assumed metapopulations have been identified based on a combination of desk based information and survey results. Details of AMP are given in Volume 5: Appendix EC-002-003.

[26] Staffordshire Wildlife Trust (2011), *Guidelines for the selection of Sites of County Biological Importance in Staffordshire Version 4.02.*

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	County/ metropolitan	AMP32 near Hanch Reservoir	AMP32 has a total of nine water bodies, four of which have been surveyed (three complete and one incomplete) and the remaining five have not been surveyed due to lack of access. This metapopulation has a medium population size class of great crested newts. This metapopulation also supports other amphibian species (smooth newt, common frog and common toad). This metapopulation lies within the land required for construction of the Proposed Scheme.
	Up to county/ metropolitan	Great crested newt populations in all water bodies not subject to full survey	Using a precautionary approach, water bodies which have not been surveyed could support moderate breeding populations of great crested newts of medium size class.
	District/borough	AMP31 west of Fradley Lock	AMP31 has a total of two water bodies, both of which have received surveys (one complete and one incomplete). This metapopulation has a small population size class (peak count of 1). This metapopulation also supports smooth newt, common frog and common toad. This metapopulation lies outside of the land required for the construction of the Proposed Scheme.
	District/borough	Palmate newt population in a water body, west of Fradley Park	This water body supports a small population size class of palmate newt; given the lack of records of this species within Staffordshire or within the local area, this is considered to be of district/borough value. This pond lies outside the land required for the construction of the Proposed Scheme.
	Local/parish	Common amphibian populations in 33 water bodies which lie outside of the four assumed great crested newt met populations identified	These water bodies (surveys complete) do not contain great crested newt but support three common amphibian species (smooth newt, common frog and common toad). All of these species are considered to be widespread within Staffordshire and within the Whittington to Handsacre area.
Birds	County/ metropolitan	Breeding barn owl at arable and grass farmland site to the south-east of Handsacre, near Kings Bromley Marina	A foraging and occasional roost site was identified within arable and grass farmland to the south-east of Handsacre. A nest site was not located, but the barn owl breeding territory falls within the land required for the construction of the Proposed Scheme. Each pair of barn owl constitutes more than 1% of the estimated county breeding population. Barn owl is a Schedule 1 species[27].
	County/ metropolitan	Breeding tree sparrow within arable fields to the south of Fradley Business Centre	Up to six pairs of tree sparrow were recorded breeding within these arable fields. This population is thought to constitute more than 1% of the estimated county breeding population. Tree sparrow is a species of principal importance.

[27] Schedule 1 birds receive full protection under the Wildlife and Countryside Act 1981 (as amended). In addition to the protection from killing or taking that all birds, their nests and eggs have under the Act, Schedule 1 birds and their young must not be disturbed at the nest.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	County/ metropolitan	Breeding and wintering tree sparrow within arable fields to immediate west of Kings Bromley Marina	Up to five pairs of tree sparrow were recorded breeding within these arable fields. This population is thought to constitute more than 1% of the estimated county breeding population. Tree sparrow is a resident species and numbers recorded in the winter also constitute more than 1% of the estimated county population.
	District/borough	Breeding lapwing within arable fields to the south of Fradley Business Centre	Up to three pairs of lapwing were recorded breeding within these arable fields. This population is thought to constitute just less than 1% of the estimated county breeding population. Lapwing is a species of principal importance.
	District/borough	Breeding yellow wagtail within arable fields to the west of Streethay	Up to three pairs of yellow wagtail were recorded breeding at Bucks Head Farm. This species is thought to be widespread in the regional arable landscape. Yellow wagtail is a species of principal importance.
	District/borough	Wintering lesser redpoll within Ravenshaw Wood and Black Slough	A maximum count of 22 lesser redpoll was recorded during the winter surveys. This species is thought to be widespread in the region during the winter months. Lesser redpoll is a species of principal importance.
	Local/parish	Breeding birds within Whittington Heath Golf Course, Whittington Heath	Breeding bird surveys recorded 43 bird species within this area of which 17 are notable. Ten notable species are thought to have bred on site, including species such as corn bunting and yellowhammer, both species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed and/or no large or important populations were recorded.
	Local/parish	Breeding birds within arable fields to the west of Streethay	Field surveys recorded 48 bird species within this area of which 24 are notable. Fifteen notable species are thought to have bred on site, including species such as corn bunting and yellowhammer. Species recorded (with the exception of yellow wagtail whose population at the site is of district/borough importance) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds along Coventry Canal, to the east of Lichfield	Field surveys recorded 45 bird species within this area of which 18 are notable. Fourteen notable species are thought to have bred along the canal, including species such as lapwing and reed bunting, a species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Breeding birds within arable fields to the south of Fradley Business Centre	Field surveys recorded 53 bird species within this area of which 27 are notable. Seventeen notable species are thought to have bred on site, including species such as reed bunting and yellowhammer, a species of principal importance. Species recorded (with the exception of tree sparrow and lapwing, whose populations at the site are of county/metropolitan and district/borough importance respectively) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within arable fields adjacent to Fradley Wood, to the west of Fradley	Field surveys recorded 26 bird species within this area of which 12 are notable. Seven notable species are thought to have bred on site, including species such as lapwing and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within Fradley Wood, to the west of Fradley.	Field surveys recorded 41 bird species within this area of which 17 are notable. Fourteen notable species are thought to have bred on site, including species such as bullfinch and spotted flycatcher, both species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within arable fields adjacent to Trent and Mersey Canal, to the west of Fradley	Field surveys recorded 39 bird species within this area of which 16 are notable. Thirteen notable species are thought to have bred on site, including species such as linnet and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within Ravenshaw Wood, Black Slough and Black Slough Farm, to the west of Fradley.	Field surveys recorded 36 bird species within this area of which 16 are notable. Eleven notable species are thought to have bred on site, including species such as grey partridge and skylark. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within Fradley Gorse, to the west of Fradley	Field surveys recorded 28 bird species within this area of which five are notable. Four notable species are thought to have bred on site, including species such as kestrel and song thrush, a species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Breeding birds within arable fields to the south of Kings Bromley Marina	Field surveys recorded 29 bird species within this area of which eight are notable. Four notable species are thought to have bred on site, including species such as reed bunting and yellow wagtail, both species of principal importance. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within arable fields to the immediate west of Kings Bromley Marina	Field surveys recorded 62 bird species within this area of which 28 are notable. Seventeen notable species are thought to have bred on site, including species such as spotted flycatcher and yellow wagtail. Species recorded (with the exception of tree sparrow whose population at the site is of county/metropolitan importance) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Breeding birds within arable field to the immediate south of Handsacre	Field surveys recorded 25 bird species within this area of which 11 are notable. Eight notable species are thought to have bred on site, including species such as skylark and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within Whittington Heath Golf Course, Whittington Heath	Wintering bird surveys recorded 31 bird species within this area of which nine are notable, including species such as lesser redpoll and woodcock (a single bird recorded on one occasion). Species recorded are considered to be common and widespread in the habitat types surveyed and/or no large or important populations were recorded.
	Local/parish	Wintering birds along Coventry Canal, to the east of Lichfield	Field surveys recorded 32 bird species within this area of which 12 are notable, including species such as lapwing and starling. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within arable fields to the south of Fradley Business Centre	Field surveys recorded 34 bird species within this area of which 14 are notable, including species such as lapwing and lesser redpoll. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within Fradley Gorse, to the west of Fradley	Field surveys recorded 35 bird species within this area of which 13 are notable, including species such as lapwing and tree sparrow. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Wintering birds within Ravenshaw Wood and Black Slough	Field surveys recorded 28 bird species within this area of which five are notable, including species such as bullfinch and woodcock. Species recorded (with the exception of lesser redpoll whose population at the site is of district/borough importance) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within arable fields to the south of Kings Bromley Marina	Field surveys recorded 33 bird species within this area of which 13 are notable, including species such as lesser redpoll and peregrine falcon. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within arable fields to the immediate west of Kings Bromley Marina	Field surveys recorded 41 bird species within this area of which 18 are notable, including species such as lesser redpoll and peregrine falcon. Species recorded (with the exception of tree sparrow whose population at the site is of county/metropolitan importance) are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
	Local/parish	Wintering birds within arable field to the immediate south of Handsacre.	Field surveys recorded 25 bird species within this area of which eight are notable, including species such as meadow pipit and yellowhammer. Species recorded are considered to be common and widespread in the habitat types surveyed, and/or no large or important populations were recorded.
Terrestrial invertebrates	County/ metropolitan	Assemblage at Whittington Heath Golf Course	Habitats with bare ground, short turf and flower foraging of high quality for invertebrates were identified. Species of interest recorded during surveys include a nationally scarce hoverfly, and a nationally scarce nomad bee of which there is only one other known population in Staffordshire (Highgate Common SSSI). The site also supports ground nesting bees and wasps which are a Staffordshire Biodiversity Action Plan priority species group.
	County/ metropolitan	Assemblage using habitats at Fradley Business Park South	Habitats with bare ground, short turf and flower foraging of high quality for invertebrates including bunds offering high quality habitat for nesting solitary bees and wasps were identified. Species of interest recorded during surveys include small heath butterfly and cinnabar moth, both species of principal importance, and a nationally rare cuckoo bee.
	District/borough	Assemblage at Ravenshaw Wood, Black Slough and the Slaish	Deadwood features present such as rot holes and deadwood which are scarce across the landscape and are sustaining a low density of deadwood-associated invertebrates including a nationally scarce beetle.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	District/borough	Assemblage at Black Slough Farm	Pasture fields and hedgerows with mature trees, some of which exhibit small levels of decay such as rot holes and deadwood, which are scarce across the landscape and are sustaining a low density assemblage of deadwood-associated invertebrates including a nationally scarce soldier beetle were identified.
	District/borough	Assemblage at Black Slough, north of Lichfield Road near John's Gorse	A series of arable fields with a flower-rich headland, stream and ley fields lined with mature trees including oak and ash were identified. A nationally vulnerable[28] hoverfly was recorded from a hedgerow ash tree with a rot hole. This is a locally rare species with only one other known locality in Staffordshire, south of Uttoxeter at Brankley Pastures Staffordshire Wildlife Trust Reserve.
	District/borough	Assemblage at Shaw Lane	This site is a series of arable fields with a flower-rich headland, stream and fields lined with mature trees including oak and ash. Surveys found the rare spider-hunting wasp.
	Local/parish	Assemblage at Fradley Wood	The site is dense woodland, scrub and semi-improved grassland. There is some limited deadwood and the invertebrate assemblage is represented by common woodland species. However, the grassland could be of higher quality to invertebrates than the results suggest due to damp and flower rich areas, which is of interest to flies and therefore has local/parish value.
Otter	District/borough	Population of otter using watercourses in the area.	Evidence of otter was found during surveys of the Trent and Mersey Canal and Bourne Brook (new and old spraints and footprints). There are also numerous desk study records of otter on the Mare Brook, Bourne Brook and Coventry Canal. A potential holt was identified on an unnamed watercourse in Ravenshaw Wood immediately adjacent to the land required for construction of the Proposed Scheme although there was no evidence of otter use. Otter has a large home range, and has increasing populations nationally and in Staffordshire. Otter is a species of principal importance.
Badger	Local/parish	At least eight badger social groups with territories located wholly or partly within the land required for the construction of the Proposed Scheme	Total of 28 setts identified within the Whittington to Handsacre area; of which one main and 15 outliers are disused. Within the land required for the construction of the Proposed Scheme there are two main setts and eight outlier setts. Badger is widespread in the UK and Staffordshire. The badger social groups within the study area are not likely to form a critical part of the county or of the district population.

[28] Red Data Book category 2 – Vulnerable, as defined in Shirt, David (1987); British Red data Books: 2. Insects; Nature Conservancy Council; Peterborough.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Reptiles	Local/parish	Population of common lizard found on Whittington Heath Golf Course	Low population size class of common lizard recorded during surveys. Common lizard is a species of principal importance and is likely to be common in suitable habitats in Staffordshire.
	Up to local/parish	Other areas of suitable habitat for reptiles not subject to survey	The overall majority of land affected by the Proposed Scheme is close grazed pasture and arable fields and only limited and isolated patches of suitable habitat have been identified as suitable for reptiles, and if present, reptiles would likely be in low numbers. There were very few desk study records of common reptiles from the surrounding area, apart from grass snake and slow worm and a record of common lizard over 1km from the land required for construction of the Proposed Scheme. Grass snake, common lizard and slow-worm are all species of principal importance. Given the distribution of adder within Staffordshire and the species' preferred habitats, and the lack of records in the area, it is unlikely that adder is present within the land required for construction of the Proposed Scheme.
Aquatic macro-invertebrates	Local/parish	Assemblage from an unnamed tributary of the Fisherwick Brook (downstream of Cappers Lane Viaduct)	Aquatic surveys of the unnamed tributary of the Fisherwick Brook identified community assemblages of limited taxon richness, although still indicative of good biological water quality. No species of conservation importance were identified.
	Local/parish	Assemblage from the Bourne Brook (downstream of Bourne Brook viaduct)	Autumn and spring surveys on the Bourne Brook identified taxon rich assemblages indicative of good biological water quality with high proportion of pollution sensitive taxa. No species of conservation importance were noted.
	Up to local/parish	Assemblage in all other watercourses in this area	In discussion with the Environment Agency, no other watercourses were identified as requiring survey although they may provide suitable habitat for commonly occurring species. Using a precautionary approach, the macro-invertebrate communities within these watercourses are assumed to have up to the highest value achieved for watercourses sampled in this area.
Fish	Local/parish	Population in the Bourne Brook	The fish assemblage within the Bourne Brook is notable for this area on account of the numerous bullhead recorded, a species of conservation niterest, and the presence of brown trout and reflects the potential of the watercourse as a valuable fishery. However, current recruitment of brown trout appears to be limited with only three individuals recorded during surveys.
	Local/parish	Population in the unnamed tributary of the Fisherwick Brook (downstream of Cappers Lane Viaduct)	Survey results from these watercourses have identified that they both support larger cyprinids at low abundance e.g. roach and chub, as well as common species. As a result of the presence of

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
	Local/parish	Population in the Curborough Brook (downstream of Pyford Brook viaduct)	larger cyprinids, within an otherwise species poor assemblage, the fisheries of these watercourses are assessed as local/parish value.
	Up to local/parish	Populations in all other watercourses in this area	In discussion with the Environment Agency, no other watercourses were identified as requiring survey although they may provide suitable habitat for commonly occurring species. Using a precautionary approach, the fish populations within watercourses where no access was available are assumed to have up to the highest value achieved for watercourses sampled in this area.
Notable plants	Local/parish	Assemblage of plants within Whittington Heath Golf Course SBI	Plants recorded during field surveys include early hair grass, heath grass, pill sedge and narrow buckler-fern. These species are all classified as uncommon in Staffordshire[29] and are associated with the heathland habitat. These areas lie within the land required for construction of the Proposed Scheme.
	Local/parish	Small-leaved lime within Big Lyntus SBI	Two small-leaved lime coppice stools were found during surveys in Big Lyntus SBI. The species is uncommon in Staffordshire. The SBI and hence the stools are not within the land required for construction of the Proposed Scheme.
	Local/parish	Populations of soft-shield fern within Ravenshaw, Black Slough and the Slaish	This plant, found during survey, is uncommon in Staffordshire. The plant was not recorded within the land required for construction of the Proposed Scheme.
	Local/parish	Veteran field maple on the field boundary of Hanchwood House Wood	Veteran trees are uncommon in Staffordshire. This example stands on the boundary of the land required for construction of the Proposed Scheme.
Water vole	Negligible	Potential populations using watercourses in the area	No confirmed evidence of water vole, a species of principal importance. Although no direct evidence of water voles has been found during field surveys, the presence of water vole remains within an otter spraint on the Bourne Brook suggests that there is a water vole population beyond the surveyed areas. There are no supporting records of water vole presence on the Bourne Brook. There was evidence of feeding on a pond adjacent to the Mare Brook, but signs of mink have also been noted in that area which can predate water voles and out-compete water vole for resources. The presence of mink recorded on this reach of the Mare Brook reduces the likelihood of water voles being present within the land required for the construction of the Proposed Scheme and current absence is assumed.

[29] Hawksford, J.E. (2013), *A Checklist of the Flora of Staffordshire*. Online at www.bsbi.org.uk/staffordshire.html. Accessed September 2013.

Species/ species group	Value	Receptor	Baseline and rationale for evaluation
Hazel dormouse	Negligible	Potential populations using suitable woody habitats in the area	No evidence has been found for the presence of hazel dormouse during surveys at each of six areas identified with potential for the species. A report from the Staffordshire Mammal Group indicates that no live dormouse has been found in the county for over three years. It is therefore unlikely that any populations exist within the land required for construction of the Proposed Scheme.
White-clawed crayfish	Negligible	Potential populations using suitable watercourses in the area	No white-clawed crayfish have been found during surveys and poor habitat suitability was identified on the remaining watercourses. Surveys have identified the presence of signal crayfish in the Trent and Mersey Canal and Coventry Canal at the confluence with the Wyrley and Essington Canal. Due to the declining status of white-clawed crayfish within Staffordshire, together with the recorded presence of non-indigenous signal crayfish, it is assumed that native white-clawed crayfish are absent from the area.

Future baseline

Construction (2017)

7.3.35 A summary of the known developments which are assumed to be mostly built and occupied prior to construction of the Proposed Scheme is provided in Section 2.1 of this report, with further details provided in Volume 5: Appendix CT-004-000. It is not expected that these developments will significantly affect the character and value of ecological resources within the area.

Operation (2026)

7.3.36 There are no known committed developments or changes to management in the Whittington to Handsacre area that will affect the operational baseline.

7.4 Effects arising during construction

Avoidance and mitigation measures

7.4.1 The following measures have been included as part of the design of the Proposed Scheme and avoid or reduce impacts to features of ecological value:

- restricting the land required for the Proposed Scheme to a minimum within Whittington Heath Golf Course SBI to reduce habitat loss within the SBI and providing an underpass to maintain PRoW Whittington 16 which will also provide connectivity for animals under the route of the Proposed Scheme;
- redesign of the road realignments near Fradley Park thus reducing land required for the construction of the Proposed Scheme and so avoiding some loss of ponds, in an area known to support amphibians and reptiles;
- redesign of the road alignment of the A515 (Lichfield Road) adjacent to Vicar's Coppice, thus reducing land required for the construction of the Proposed

Scheme and reducing loss of ancient woodland within Vicar's Coppice BAS;

- realignment of the Manchester spur closer to the main line which has reduced the land required for the Proposed Scheme within Fradley Wood BAS;
- realignment of local road diversions to avoid direct impact upon Big Lyntus SBI;
- the installation of the following underpasses will allow animals such as bats to pass beneath the route of the Proposed Scheme: Whittington Footpath 16 underpass, Streethay Footpath 6 underpass, Alrewas Footpath 31 underpass, Kings Bromley Footpath 0.392 underpass;
- Lichfield Road underbridge, Broad Lane underbridge, Wood End Lane underbridge and A515 Lichfield Road underbridge will allow bats to pass beneath the route of the Proposed Scheme;
- viaducts over the Trent and Mersey Canal, Curborough Brook, Wyrley and Easington Canal and the adjacent watercourse (unnamed tributary of Fisherwick Brook), and the Bourne Brook will retain wildlife connectivity along these watercourses for species such as bats and otter; and
- all culverts will be suitable to allow passage for mammals such as otter and water vole, taking into account flood events, or will have an alternative dry tunnel installed.

7.4.2 The assessment assumes implementation of the measures set out within the draft Code of Construction Practice (CoCP) (see Volume 5: Appendix CT-003-000), which includes translocation of protected species where appropriate.

Assessment of impacts and effects

Designated sites

7.4.3 There will be permanent loss of 8.0ha from Whittington Heath Golf Course SBI, consisting of a mixture of acid grassland, heather and semi-mature oak/birch woodland, which is approximately 13% of the 65ha SBI. The remaining habitat will be severed and the retained areas either side of the land required for construction of the Proposed Scheme will be smaller in size (approximately 30ha and 26ha respectively, west and east) and more vulnerable to long-term degradation through edge effects. Heathland is not widespread in the local area and is a habitat of principal importance and a Staffordshire Biodiversity Action Plan priority habitat. It also provides an important habitat for invertebrates, so the reduction in habitat resource could also result in an adverse effect on the conservation status of invertebrate assemblages within the SBI which are a reason for designation. These impacts will lead to an adverse effect on site integrity which will be significant at a county/metropolitan level.

7.4.4 The Proposed Scheme will result in permanent loss of 9.4ha from Ravenshaw Wood, Black Slough and Slaish SBI, together with severance of the woodland blocks. This will amount to approximately 42% of the 22.3ha SBI. Part of the habitat within the Slaish is ancient woodland and some is wet woodland on peat; these habitats cannot be recreated. The retained pockets of woodland either side of the Proposed Scheme will be smaller in size and more vulnerable to long-term degradation through edge effects

such as encroachment of scrub, and wind throw during storms. These impacts will lead to an adverse effect on site integrity that will be significant at a county/metropolitan level.

7.4.5 The majority of John's Gorse SBI lies within the extent of land required for construction of the Proposed Scheme (1.9ha or 80% of the 2.4ha SBI). This habitat loss will result in a permanent adverse effect on site integrity that will be significant at the county/metropolitan level.

7.4.6 There will be permanent loss of 200m from Curborough House Hedgerows SBI (134m and 66m from the two component hedgerows or 12% of the entire 1663.4m SBI). This will result in an adverse effect on the integrity of the SBI that will be significant at a county/metropolitan level.

7.4.7 A narrow strip on the northern edge of Vicar's Coppice BAS (0.4ha, which represents 6% of the 7.1 BAS) will be permanently lost due to the realignment of Wood End Lane and works on the A515 (Lichfield Road). Although the woodland appears as semi-natural ancient woodland on the ancient woodland inventory, the citation indicates that the woodland was clear felled in 1914-18 and selectively cleared in the 1970's. The site is also degraded, and there is abundant rhododendron within the roadside habitat that lies within the land required for construction of the Proposed Scheme. There would be no fragmentation or severance of the woodland and this small loss of already degraded edge habitat is not expected to result in a significant adverse effect on integrity of the BAS.

7.4.8 There will be 2.8ha of habitat loss within Fradley Wood BAS, which is almost 10% of the BAS. The woodland comprises blocks of both conifer and broadleaved plantation, some of which has recently been cleared. The majority of the habitat lost will be coniferous woodland from the edge of Brokendown Wood, and from deciduous woodland on the edge of Fradley Wood which lay either side of the Trent and Mersey Canal. Although there will be permanent loss of habitat, this would be from replanted and open habitats which have been degraded due to previous planting, felling and grazing. There would be no effect on other blocks of woodland within the BAS and the Proposed Scheme would not result in severance or fragmentation of the woodland. These impacts are not expected to have a significant effect on the integrity of the BAS.

7.4.9 Although the Trent and Mersey Canal and Coventry Canal, Kings Bromley Wharf to Fradley Junction and from Fradley Junction to Fradley Bridge SBI will be crossed by the Trent and Mersey Canal East and West viaducts, there will be no habitat loss and no loss of the functioning of the canals as a wildlife corridor. There could be shading effects on the marginal and emergent vegetation, one of the reasons for designation, created by the viaducts; a stretch of approximately 240m of the SBI will be directly underneath the viaduct decks (0.7% of the entire 3.4km stretch of SBI). An NVC survey in 2012 on the section of the canal which will be beneath the viaducts identified that there were no notable plant species. It is not expected that shading of this small section of the SBI will result in a significant effect on the integrity of the SBI.

7.4.10 There will be loss of 0.1ha of habitat from the edge of Tuppenhurst Lane (west of) SBI (approximately 4% of the 3.18ha SBI). There would be no severance or fragmentation

of the habitat. It is not expected that this loss will have a significant effect on the integrity of the SBI.

7.4.11 No impacts are expected on Big Lyntus SBI, Wood End Lock (south-east of) SBI and Tomhay Wood SBI which form part of the baseline.

Habitats

7.4.12 There will be approximately 5.4ha of ancient woodland habitat lost within this area from Ravenshaw Wood, Vicar's Coppice, John's Gorse and Hanchwood House Wood. Some of these woodlands are likely to have previously formed a more contiguous area of woodland which has been fragmented and degraded. This loss will result in a permanent adverse effect on the conservation status of ancient woodland which will be significant, in each case, at a county/metropolitan level.

7.4.13 There will be 20.5ha of woodland lost within the area including from Ravenshaw Wood, Black Slough, the Slaish, Fradley Wood and Vicar's Coppice. Ravenshaw Wood, Black Slough and the Slaish form a single woodland unit and, together with Vicar's Coppice, contain ancient woodland. Loss within these woodlands will result in an adverse effect on the conservation status of the woodland that would be significant at a county/metropolitan level. Loss within Fradley Wood is not expected to result in significant adverse effect on the conservation status of this woodland. Losses of woodland that will be significant at a local/parish level are reported in Volume 5: Appendix EC-005-003.

7.4.14 There are 31.7km of hedgerows within the land required for the construction of the Proposed Scheme. This includes 376m from four individual hedgerows that meet the wildlife and landscape criteria of the Hedgerows Regulations 1997. The final length of hedgerow to be lost will depend on the detailed design and they will be retained where practical, but as a precautionary approach for the purposes of assessment, it is assumed that all of the hedgerows would be lost. The majority of hedgerows that will be lost are species-poor. Hedgerows form wildlife corridors within a largely arable landscape and are therefore important for habitat connectivity. The loss of the two hedgerows within Curborough House Hedgerow SBI will result in an adverse effect on the conservation status of the two component hedgerows that will be significant at a county/metropolitan level. Loss of the two important hedgerows east of Woodend Cottage, near Fradley Junction, important for habitat connectivity, will result in an adverse effect on the conservation status of these hedgerows that will be significant, in each case, at a district/borough level. The combined loss and severance of other hedgerows within the Proposed Scheme will cause an adverse impact on the conservation status of the network of hedgerows which will be significant at the district/borough level.

7.4.15 Taking a precautionary approach to assessment, the loss of ponds within the land required for the construction of the Proposed Scheme could result in a permanent adverse effect on the conservation status of water bodies that would be significant at up to the district/borough level.

7.4.16 It is considered unlikely that any other effects on habitat receptors at more than the local/parish level will occur. Effects significant at the local/parish level are listed in Volume 5: Appendix EC-005-003.

Species

7.4.17 The removal or disturbance of habitat features that are utilised by bats during breeding, hibernation or migrating between roosts are 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 conservation status of the population concerned will differ dependent on the status of the species concerned.

7.4.18 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 and noise 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.

7.4.19 Two confirmed transient building roosts for common pipistrelle and brown long-eared will be affected within the land required for construction of the Proposed Scheme due to demolition of a residential building along Shaw Lane (part of the assemblage of bats using habitats fronting Shaw Lane and Tuppenhurst Lane including Bourne Brook, John's Gorse and Harvey's Rough) and a residential building along Darnford Lane near Lichefiled. Given that only individual bats were found to use the buildings as a transient non-breeding roost, the loss of the buildings will not significantly affect the conservation status of common pipistrelle or brown long-eared bat.

7.4.20 There is a possible Daubenton's maternity roost at a residential building east of Ravenshaw Wood, adjacent to the Trent and Mersey Canal. Noise and vibration arising during construction of the Trent and Mersey Canal viaducts will result in disturbance and could lead to temporary displacement of bats from the roost. However, the adoption of measures within the draft CoCP will provide controls to reduce the risk of displacement of bats and the loss of this roost. It is likely that the habitats associated with the Trent and Mersey Canal will support commuting and foraging activity by bats using this roost. Activity by Danbenton's bat was confirmed along the canal during transect surveys. The bats using this roost will not become isolated from key commuting and foraging provided along the canal and connectivity along the watercourse will be retained both during and following construction. With these measures in place, there are no significant effects expected on the conservation status of the population of Daubenton's bat using the roost.

7.4.21 Habitats within Whittington Heath Golf Course SBI that lie within land required for the construction of the Proposed Scheme support a diverse assemblage of bats including rarer bat species: noctule, Nathusuius' pipistrelle, Leisler's, serotine and *Myotis* sp. A small number of trees with moderate potential to support bats will be lost although no known building or tree roosts would be removed. Key commuting and foraging habitat will be permanently lost from the golf course. However, these impacts will be localised. One confirmed transient building roost for common pipistrelle and brown long-eared bat along Darnford Lane, likely to be associated with this assemblage, lies within 100m of land required for the construction of the Proposed Scheme. The majority of habitats within the golf course used by foraging and commuting bats lie outside of land required for the construction of the Proposed Scheme and will still be

available for commuting and foraging during and following construction, including for species using the confirmed building roost along Darnford Lane. These impacts are unlikely to lead to a significant adverse effect on the conservation status of the assemblage of bats concerned.

7.4.22 Habitats associated with the Wyrley and Essington Canal are used by a diverse assemblage of bats including common pipistrelle, soprano pipistrelle, *Myotis* sp., noctule and Leisler's. The Wryrley and Essington Canal will still be available as a commuting and foraging corridor during and following construction. The installation of Cappers Lane viaduct will retain connectivity along the canal and impacts are unlikely to lead to a significant adverse effect on the conservation status of the assemblage of bats concerned.

7.4.23 Habitats adjacent to Fradley Business Park, west of Wood End Lane, are used by a diverse assemblage of bats including: common pipistrelle, soprano pipistrelle, brown long-eared bat, *Myotis* sp., noctule and Nathusuius' pipistrelle. The mosaic of grassland habitat, watercourses, water bodies and network of hedgerows south of Fradley Park forms key commuting and foraging habitats within a predominantly arable landscape. The network of hedgerows is likely to provide links between foraging habitats and buildings within Fradley which may support roosting bats. The wider countryside north of Streethay is dominated by large arable fields with low gappy hedgerows which limits the potential for habitats within the wider countyside to support high densities of foraging/commuting bats. The Proposed Scheme will result in the permanent loss and severance of key commuting and foraging habitat. While the losses of habitat will be localised, this loss will increase the fragmentation of commuting and foraging habitats and reduce the foraging resource for bats. The installation of Alrewas Footpath 31 underpass will minimise impacts of habitat severance for low flying species. Whilst the inclusion of Mare Brook North and South culverts (approximately 2m x 2m) will reduce the impact of habitat severance along the watercourse for some species of bat, including *Myotis* sp., other species recorded using habitats surrounding the watercourse, including common and soprano pipistrelles and noctule, are less likely to use the culvert. These impacts will lead to an adverse effect on the conservation status on the assemblage of bats concerned that will be significant at a district/borough level.

7.4.24 The Trent and Mersey Canal and adjacent woodlands are used by a diverse assemblage of bats including common pipistrelle, soprano pipistrelle, brown long-eared, Daubenton's, Natterer's, Leisler's, noctule, Nathusuius' pipistrelle and serotine. Construction will result in the permanent loss and severance of habitats within Ravenshaw Wood, Black Slough and the Slaish. One tree roost within Black Slough found to support individuals of noctule, a rarer bat species, lies within land required for the construction of the Proposed Scheme and will be lost. A further two tree roosts at Black Slough which could support individuals of rarer bat species, which have been confirmed using adjacent habitats, will also be lost. A soprano pipistrelle tree roost within Black Slough and a noctule tree roost within Ravenshaw Wood will become isolated within retained remnants of woodland and bats using the roost are likely to be subject to disturbance during construction. Tree roosts with high and moderate potential to be used by roosting bats located within Ravenshaw Wood, Black Slough and the Slaish will be lost. It is considered likely that these trees are used by noctule

and soprano pipistrelle due to the tendency of bats to move regularly between tree roosts. Given the number of trees to be removed and the low cover of woodland within the immediate area, this could remove a large proportion of the available roosting resource for the bat assemblage. Connectivity along the Trent and Mersey Canal will be retained. However, woodland clearance will result in the loss of key bat foraging habitat and the severance of commuting routes along woodland edges and connecting hedgerows. Work proposed for the diversion of the high-pressure National Grid gas pipeline will further increase woodland severance within Black Slough and the Slaish. The Proposed Scheme will create a linear gap, of minimum width 40m, between adjacent stands of retained woodland in Ravenshaw Wood, Black Slough and the Slaish. This may discourage bat species which avoid commuting and foraging in open habitats such as some *Myotis* sp. and brown long-eared bat. This would restrict the foraging and commuting resource available for some species. The combination of these impacts will result in a temporary adverse effect on the conservation status of the assemblage of bats concerned that will be significant at a county/metropolitan level.

7.4.25 Woodland habitat is to be lost at John's Gorse, Harvey's Rough and along Bourne Brook which is used by the assemblage of bats recorded within habitats fronting Shaw Lane and Tuppenhurst Lane including: common pipistrelle, soprano pipistrelle, *Myotis* species, Nathusuius' pipistrelle, Leisler's, serotine and noctule. No known tree roosts will be lost however trees with high and moderate potential to be used by roosting bats will be lost. The Proposed Scheme will result in the permanent loss and severance of key commuting routes and key foraging habitat along woodland edge and hedgerows but connectivity along the Bourne Brook will be retained. These severance impacts may deter bats from using the habitats and move bat populations away from preferred foraging and commuting habitats. One confirmed transient building roost for soprano pipistrelle and brown long-eared bat, likely to be associated with the assemblage of bats, will be affected within the land required for construction of the Proposed Scheme due to demolition of a residential building along Shaw Lane. The combination of these impacts will lead to an adverse effect on the conservation status of the assemblage of bats concerned that will be significant at a district/borough level.

7.4.26 There would be loss of three water bodies and approximately a third of available terrestrial habitat within the assumed great crested newt metapopulation AMP29, south-west of Fradley. The terrestrial habitat affected would include grassland, woodland and hedgerows which could be suitable for foraging, refuge and hibernation. The metapopulation will be fragmented by the Proposed Scheme with one water body separated to the south-west of the route isolated from terrestrial habitat and other water bodies retained to the north-east of the route. The Proposed Scheme will result in permanent adverse effects on the conservation status of the metapopulation which will be significant at the county/metropolitan level.

7.4.27 There would be no loss of water bodies within the assumed great crested newt metapopulation AMP32, at Hanch Reservoir, but there may be minimal loss of terrestrial habitat resulting from utilities works. The terrestrial habitat affected would include a small section of arable field and hedgerow. This impact would not result in an adverse effect on the conservation status of the metapopulation and would not be

significant. There are no expected impacts on the other assumed great crested newt metapopulations within the area (AMP30 and AMP31).

7.4.28 There will be loss of 26 water bodies outside of assumed great crested newt metapopulations. Ten of these have received complete surveys, and support common amphibians. The remaining 16 water bodies within the land required for construction of the Proposed Scheme have either not been surveyed or have received incomplete surveys. Taking a precautionary approach to assessment, loss of these water bodies could result in an adverse impact on amphibian populations that would, in each case, be significant at up to a county/metropolitan level.

7.4.29 Woodland loss during construction, particularly at Ravenshaw Wood, where a potential holt has been identified, would remove potential otter resting habitat. Due to the design of the viaducts/overbridges there will be no permanent loss of accessible watercourse for otters. In addition, the bridging of watercourses may offer further cover and territorial marking sites for otters, dependent on final design. Construction activities along watercourses including the Mare Brook and Trent and Mersey Canal may result in noise and visual disturbance to otter, potentially acting as a deterrent to otter commuting, causing temporary barriers within an otter's territorial range. The realignment of approximately 125m of the Mare Brook has the potential to temporarily restrict the movement of otters and reduce foraging opportunities. These impacts will not result in a significant adverse effect on the conservation status of the otter population concerned.

7.4.30 The reduction in habitat resource within Whittington Heath Golf Course SBI could result in an adverse effect on the conservation status of the associated invertebrate assemblage which would be significant at the county/metropolitan level.

7.4.31 The permanent loss of woodland within Ravenshaw Wood and Black Slough will cause in a reduction in woodland and deadwood resource and will result in an adverse impact on the conservation status of the associated invertebrate assemblage which will be significant at a district/borough level.

7.4.32 The construction process is likely to deter notable bird species from using the area of land required for the construction of the Proposed Scheme during winter months, as a result of loss of habitat, and also visual and noise disturbance as a result of the construction works. This avoidance will be temporary, lasting the duration of the construction process. The impacts could cause adverse affects on the conservation status of bird populations which are likely to have a significant effect at up to the local/parish level.

7.4.33 The construction process will cause temporary loss of habitats used by birds, together with disturbance of adjacent habitats. In areas of open farmland this will cause minimal effect as there is abundant suitable alternative habitat nearby. However, for the woodlands at Ravenshaw, Black Slough and the Slaish and Fradley Wood, some of the affected species will have less alternative habitat to utilise and the effect is considered to be significant at local/parish level.

7.4.34 The occasional barn owl roost site observed south-east of Handsacre, near Kings Bromley Wharf, will not be lost. There will be loss of some suitable foraging habitat within the likely barn owl territory. However, evidence shows that the barn only

occasionally use this area and nest further afield. Therefore the barn owl pair is not expected to be displaced as a result of construction and no significant effect on the barn owl pair is expected. It is considered unlikely that any other effects at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-003.

Other mitigation measures

7.4.35 This section describes and assesses additional elements designed to reduce or compensate for significant ecological effects.

7.4.36 Ancient woodland is irreplaceable. The loss of approximately 5.4ha of ancient woodland within Ravenshaw Wood, Vicar's Coppice, John's Gorse and Hanchwood House Wood will result in a permanent significant adverse effect, in each case, at a county/metropolitan level. However, this loss of woodland will be compensated for through a range of measures. Ancient woodland soil with its associated seed bank will be carefully removed and translocated to a 2.5ha receptor site adjacent to the retained part of Ravenshaw Wood and to approximate 1ha areas adjacent to Vicar's Coppice and John's Gorse. Other measures may also be appropriate such as planting native tree and shrub species of local provenance, and translocating coppice stools and dead wood.

7.4.37 To compensate for the loss of woodland habitat in the northern section of this area, notably from Ravenshaw Wood, Black Slough and the Slaish, John's Gorse, Fradley Wood, Hanchwood House Wood, and Vicar's Coppice, the Proposed Scheme includes 21ha of woodland planting. This will include 9.6ha of woodland planting adjacent to retained sections of Ravenshaw Wood, Black Slough and the Slaish, 6.2ha of woodland planting contiguous with Vicar's Coppice and 7.2ha adjacent to John's Gorse and Hanchwood House Wood (in addition to the area for translocation of ancient woodland soils). This planting will provide woodland links between the retained sections of Ravenshaw Wood and the Slaish, and between Vicar's Coppice and Tomhay Wood to the south of the Proposed Scheme. The target condition for these woodlands would be the habitat of principal importance lowland mixed deciduous woodland. Although it would take 50 years or more for this planting to mature, many animals are likely to be able to utilise the new woodland creation areas prior to maturation and scrub planting is likely to establish within 10 years of planting. This compensation will result in a permanent beneficial effect on the conservation status of woodland habitat which will be significant at a district/borough level.

7.4.38 There will be replacement woodland and scrub planting between the Trent and Mersey Canal East and West Viaducts to mitigate for loss within Fradley Wood. Although the woodland required for the construction of the Proposed Scheme is mainly conifer plantation, the mitigation planting offers an opportunity to increase the conservation value of the remaining woodland.

7.4.39 Further compensation for the loss of undesignated secondary woodland will include an area of woodland planting provided east of the proposed railway and north of the WCML to replace habitat at Fulfen Wood required for the construction of the Proposed Scheme and to extend the size of the retained section of Fulfen Wood. Additionally, woodland planting is proposed to extend the size of Little Lyntus Wood between the realigned Wood End Lane and the existing Wood End Lane. These areas

of compensation planting address local/parish effects as detailed in Volume 5: Appendix EC-005-003.

7.4.40 Following establishment and maturation of planting any adverse impacts on secondary woodlands will be reduced to a level which will not result in any significant effect on the conservation status of woodland.

7.4.41 New hedgerow creation will be undertaken and connected habitat is provided within the landscape scheme to compensate for losses of wildlife corridors that hedgerows provide. There will be temporary adverse effects whilst the new hedges become established and mature (approximately 15 years). However, many species will be able to use the new hedges prior to maturation. Following establishment and maturation of planting, it is expected that any adverse impacts on hedgerows and the wildlife corridors they create will be reduced to a level which will not result in any significant effect on the conservation status of the habitat.

7.4.42 A 19ha heathland and acid grassland creation area has been identified near the A51 Tamworth Road (which is in the Drayton Bassett, Hints and Weeford area (CFA21) to replace and translocate habitat required for the construction of the Proposed Scheme within Whittington Heath Golf Course SBI. This will include translocation of turves and/or topsoil of affected habitat and will create a heathland and acid grassland mosaic. Following establishment which will take approximately 20 years, and with appropriate management, it is expected that any adverse impacts will be reduced to a level which will not result in any significant effect on the conservation status of the habitats concerned.

7.4.43 Appropriate habitats will be provided for terrestrial invertebrates within the ecological compensation areas near Whittington Heath Golf Course and Fradley Business Park through a range of measures to be determined at detailed design. These measures are likely to include creation of bunds (beetle banks) and sowing with species-rich seed mixes. Retention of felled trees within the new planting areas adjacent to Ravenshaw Wood, Black Slough and the Slaish will retain deadwood habitat for invertebrates. Following these measures it is expected that any adverse impacts will be reduced to a level which will not result in any significant effect on the conservation status of the terrestrial invertebrate assemblages concerned. Additional measures to those within the draft CoCP will be implemented to reduce disturbance impacts on roosting, foraging and commuting bats in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2). The woodland creation areas near retained sections of Ravenshaw Wood, Black Slough and the Slaish and near Fradley Business Park will replace foraging habitat for bats. Planting will also provide links to the wider landscape to reduce effects of habitat severance. Alternative roosting structures will be provided within the Proposed Scheme to replace those lost including roosts for noctule bats within the retained sections of Ravenshaw Wood, Black Slough and the Slaish. Replacement roosts will be provided following the principles of ecological mitigation within the SMR Addendum (Volume 5: Appendix CT-0001-000/2). Habitat connectivity will be maintained under the Proposed Scheme due to the presence of Cappers Lane Viaduct, Streethay Footpath 6 underpass, Streethay viaduct, Alrewas Footpath 31 underpass, Trent and Mersey Canal east and west viaducts and Pyford Brook viaduct, Kings Bromley 0.392 underpass and the Bourne Brook viaduct. Planting will be designed to

encourage species such as bats to use these crossing points. Following the implementation of the measures proposed it is expected that any adverse impacts on bats during the construction of the Proposed Scheme will be reduced to a level at which they will not result in any significant effect on the conservation status of the species concerned.

7.4.44 Compensatory habitat to address impacts on the great crested newt metapopulation south-west of Fradley, on amphibian populations and on individual ponds will be provided within the ecological habitat creation areas near Fradley Business Park and Whittington Heath Golf Course, in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2). This will include the provision of replacement ponds, terrestrial habitat and hibernation habitat sufficient to maintain the favourable conservation status of the population effected. The ecological compensation areas near Fradley Business Park and Whittington Heath Golf Course will also be suitable for reptiles.

7.4.45 Mitigation measures to address the potential killing, injury and disturbance of badgers will be provided in accordance with the principles of ecological mitigation identified within the SMR Addendum (Volume 5: Appendix CT-001-000/2). This will include the provision of badger proof fencing and replacement setts where necessary.

Summary of likely residual significant effects

7.4.46 The mitigation, compensation and enhancement measures described above reduce the effects to a level that is not significant, except for ancient woodland within: Ravenshaw Wood, Black Slough and the Slaish; John's Gorse and Hanchwood House Woodlands; and Vicar's Coppice.

7.4.47 Due to the amount of woodland provided as compensatory habitat, particularly in the north of the area, there will be a permanent beneficial effect on the conservation status of woodland habitat.

7.5 Effects arising from operation

Avoidance and mitigation measures

7.5.1 The following measures have been included as part of the design of the Proposed Scheme and avoid or reduce impacts on features of ecological value:

- connectivity will be maintained under the Proposed Scheme due to the presence of Cappers Lane Viaduct, Streethay Footpath 6 underpass, Streethay viaduct, Alrewas Footpath 31 underpass, Trent and Mersey Canal east and west viaducts and Pyford Brook viaduct, Kings Bromley 0.392 underpass and the Bourne Brook viaduct. These spaces beneath these structures will offer animals a way of passing beneath the route of the Proposed Scheme and will reduce the risk of collisions with trains;
- planting is designed to encourage species such as bats to use these crossing points; and
- the absence of woody species being planted along the slopes of the embankment will result in a low density of bat species using the embankments for foraging and commuting thus reducing the risk of collision.

Assessment of impacts and effects

7.5.2 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.

7.5.3 Noise, vibration and lighting from 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. There is some evidence to suggest that gleaning bats, such as brown long-eared, will have reduced foraging success within areas where there is persistent noise from busy roads. However, noise generated from passing trains will be regular but temporary and as such will differ from that resulting from a busy road.

7.5.4 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 would 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.

7.5.5 Where the route of the Proposed Scheme bisects, or is located in close 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 habitat of the species or species concerned and the vertical alignment of the Proposed Scheme (i.e. is the railway in cutting, on embankment, on a viaduct, or at grade) at the point the impact occurs.

7.5.6 The following species have been identified within the area that could be particularly at risk of collision with trains: Natterer's, Daubenton's, noctule, pipistrelle and brown long-eared bat. The proximity of confirmed noctule tree roosts within Ravenshaw Wood and Black Slough to the route of the Proposed Scheme increases the risk of collision for this species as bats emerge from roosts and exit the woodland at a low height. Viaducts within the Whittington and Handsacre area will cross watercourses used by foraging and commuting bats: Cappers Lane viaduct over the Wyrley and Essington Canal, the Trent and Mersey Canal viaducts, the Pyford viaduct over Curborough Brook, and the Bourne Brook viaduct. Most bat species will fly underneath these structures by following the watercourse under them whilst the higher flying noctule, Leisler's and serotine are likely to navigate over the structures. The deck of the two viaducts at the Trent and Mersey Canal and of the Cappers Lane viaduct over the Wyrley and Essington Canal will have a clearance of 3m above the canal. The installation of a viaduct with clearance above the Bourne Brook of over 9m will encourage bat species to cross beneath the route of the Proposed Scheme and reduce the risk of some bats flying up and over the structures and into the path of

moving trains. Although there is a risk of individual bats being killed or injured by collision with trains, the impacts are unlikely to result in significant effects on the conservation status of any of the species concerned.

7.5.7 Given the concentration of bats in the vicinity of Ravenshaw Wood, Black Slough and the Slaish where the railway will be on low embankment immediately adjacent to retained sections of woodland, there could be an increased risk of collision of bats with trains. This would be as a result of bats gliding at low height from roost sites and following established commuting routes along woodland edges crossed by the route of the Proposed Scheme. Low flying Myotis species and brown long-eared bats and noctules leaving roost sites at low height would be particularly at risk.

7.5.8 The noise made by passing trains has the potential to disturb birds within habitats close to the Proposed Scheme. Birds habituate to loud noises that they hear regularly and frequently, and hence it is considered that this will not generally cause significant effects. There is some evidence to suggest that breeding bird densities can be reduced where there is persistent noise from busy roads due to birds being unable to hear each other's songs. However, this is not expected to occur with the Proposed Scheme as trains will pass quickly. The effect of train noise on breeding birds is therefore not considered to be significant.

7.5.9 It is considered unlikely that any other effects on species receptors significant at more than the local/parish level will occur. Effects significant at the local/parish level are listed in Volume 5: Appendix EC-005-003.

Other mitigation measures

7.5.10 This section describes and assesses additional elements designed to reduce or compensate for significant ecological effects. These include measures to discourage bats from foraging close to the Proposed Scheme including planting that has been designed to create a 'funnel' effect to encourage bats to fly beneath the Proposed Scheme, notably in the vicinity of the Wyrley and Essington Canal, the Trent and Mersey Canal, the Curborough Brook, and the Bourne Brook, rather than up and over the railway.

7.5.11 In the Ravenshaw Wood, Black Slough and the Slaish, two measures have been introduced to address the impacts of habitat loss and severance on bat populations in the area. Firstly, to reduce the risk of collision with trains where woodland habitat is severed in Ravenshaw Wood, Black Slough and the Slaish, a physical barrier will be installed at the top of the embankment slopes on both sides of the route between the Trent and Mersey Canal viaducts and the Kings Bromley Footpath 0.392 underpass. These will force bats up and over the route of the Proposed Scheme and reduce the risk of collision with trains. Secondly, new woodland planting will enhance habitat connectivity, commuting, foraging and roosting opportunities away from the route of the Proposed Scheme. The new woodland edges will be set back from the route and will be scalloped to create sheltered areas favoured by insects and provide suitable commuting and foraging areas away from the railway. These rides and woodland edges will be designed to encourage the bats to fly toward the Trent and Mersey Canal viaducts and the Kings Bromley Footpath 0.392 underpass.

7.5.12 The barn owl pair using the territory south-east of Handsacre, near Kings Bromley Wharf, are known to occasionally forage in the area of land crossed by the Proposed Scheme. As part of the precautionary assessment it is assumed all territories within close proximity to the route could be lost and therefore adverse effects are likely to remain significant at the county/metropolitan level. The barn owls are therefore at risk of collision with trains. To offset these losses opportunities to provide barn owl nesting boxes in areas greater than 1.5km from the route will be explored with local landowners. As the availability of nesting sites is a limiting factor for this species the implementation of these measures would be likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.

Summary of likely residual significant effects

7.5.13 The mitigation, compensation and enhancement measures described above reduce the residual ecological effects during operation to a level that is not significant, except for the barn owl pair south-east of Handsacre near Kings Bromley Wharf. Train strike is likely to result in the loss of this barn owls pair that nest close to the route resulting in a residual significant effect. However, if 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.

8 Land quality

8.1 Introduction

8.1.1 This section presents the baseline conditions that exist along the Proposed Scheme in relation to land quality and reports the likely impacts and any significant effects resulting from the construction and operation of the Proposed Scheme. Consideration is given to land that potentially contains contamination and land that has special geological significance, either from a scientific, mining or mineral resources point of view, including: geological sites of special scientific interest (SSSI), local geological sites (LGS), areas of current underground or opencast mining and areas of designated mineral resources. Mitigation measures are presented and any residual effects are summarised.

8.1.2 Potentially contaminative areas of land have been identified that could affect, or be affected by, the construction of the Proposed Scheme (for example contaminated soils may need to be removed or the construction may alter existing contamination pathways). Each of these areas has been studied to evaluate the scale of potential impacts caused by existing contamination (if present) and what needs to be done to avoid significant consequences to people and the wider environment. In addition, a review has been undertaken to establish whether the operation of the Proposed Scheme will lead to contamination of its surrounding environment and what needs to be done to prevent such contamination.

8.1.3 The main environmental features of this area include the Wyrley and Essington Canal, Mare Brook (including several of its tributaries), the Trent and Mersey Canal, Pyford Brook, Bourne Brook and widespread areas of sand and gravel (bedrock derived and superficial), all of which represent identified mineral resources.

8.1.4 The main land quality issues in this area include the presence of the following within the land required for the construction and operation of the Proposed Scheme:

- areas of former or current potentially contaminative land use which the Proposed Scheme will cross such as a former airfield/military land, the West Coast Main Line (WCML), the South Staffordshire Line and a garage; and
- three Mineral Consultation Areas[30] (MCA) – one bedrock derived sand and gravel MCA (underlying Whittington Heath) and two superficial sand and gravel MCA (the first is located just north of Streethay and the second extends from Gorse Farm to the northern edge of the study area).

8.1.5 Details of baseline information and the land quality assessment methodology are outlined in the following appendices (presented in Volume 5):

- Appendix CT-001-000/1: the SMR and Appendix CT-001-000/2 the SMR addendum; and

[30] Mineral Consultation Areas (MCA) are provided by some county councils to ensure that in two-tier authority areas consultation takes place between county and district planning authorities when mineral interests could be compromised by proposed non-minerals development. MCA also give an additional measure of safeguarding to sites related to minerals infrastructure, such as wharves and railway sidings, that cannot be protected by MSA. British Geological Survey (2007), Report CR/07/060A guide to mineral safeguarding in England.

- Appendix LQ-001-022: Land quality appendix.

8.1.6 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding groundwater resources are addressed in Section 13 Water resources and flood risk assessment. Issues regarding the disposal of waste materials, including contaminated soils, are addressed in Volume 3: Section 14.

8.1.7 Engagement has been undertaken with Lichfield District Council (LDC) and the Environment Agency regarding contaminated land and with Staffordshire County Council (SCC) regarding mineral resources.

8.2 Scope, assumptions and limitations

8.2.1 The assessment scope, key assumptions and limitations for the land quality assessment are set out in Volume 1 and in the SMR and its addendum presented in Volume 5 (Appendices CT-001-000/1 and CT-001-000/2). This section follows the standard assessment methodology.

8.2.2 Baseline data were reviewed for the area of land required to construct the Proposed Scheme together with a buffer extending out for a minimum of 250m, but in the case of groundwater data up to 1km. This is defined as the study area.

8.2.3 Areas of utility diversion works in existing highways have been excluded because with respect to land quality issues, utility works within the highway are a low risk construction activity, as most of the excavation works will be within the highway construction layers, and re-instatement will be undertaken with highway construction materials.

8.2.4 Familiarisation visits to the study area were made in October 2012 where the location of the Proposed Scheme was viewed from points of public access only. No key sites were identified in the study area which required site walkover surveys. Key sites are those which are considered to have the greatest potential for contamination and are considered to be at risk of being affected by the Proposed Scheme.

8.3 Environmental baseline

Existing baseline

8.3.1 Unless otherwise stated, all features described in this section are presented in Volume 5, Map Book – Land Quality Maps LQ-061b to LQ-065.

Geology

8.3.2 This section describes the underlying ground conditions within the study area. It first describes any made ground present, followed by near surface superficial deposits and lastly describes the deeper bedrock geology. The geological mapping is illustrated in Volume 5: Map Book – Land Quality Map WR-02-22.

8.3.3 The presence of made ground is not indicated on British Geological Survey (BGS) mapping, but there is likely to be made ground associated with the WCML and the South Staffordshire Line, existing highways, the Wyrley and Essington Canal, the Trent and Mersey Canal and various small areas of infilling, including infilled pits, infilled ponds and infilled domestic water wells scattered throughout the study area.

8.3.4 There is a landfill at Lichfield Road, south of Handsacre which is listed as an historical landfill which accepted industrial (pottery) waste.

8.3.5 Superficial Deposits intermittently underlie the areas traversed by the Proposed Scheme. The Proposed Scheme will cross the following:

- Alluvium comprising clay, silt, sand and gravel, and River Terrace Deposits (sand and gravel) associated with major surface watercourses;
- Glaciofluvial Sheet Deposits (comprising sand and gravel with lenses of clay, silt and organic material), which underlie the Proposed Scheme almost continuously from Gorse Farm at Fradley to the northern end of the study area; and
- Head Deposits, variably comprising clay, silt, sand and gravel, present to the north of Streethay.

8.3.6 Bedrock of the Triassic period underlies the Proposed Scheme. The Sherwood Sandstone Group, (comprising the Bromsgrove Sandstone Formation and Kidderminster Formation) comprises pebbly, gravelly sandstone, and is present from the southern end of the study area as far north as Hill Farm at Streethay. The Mercia Mudstone Group, described as red and green-grey mudstones and subordinate siltstones with widespread thin beds of gypsum/anhydrite, underlies the Proposed Scheme from Hill Farm at Streethay to the northern end of the study area.

Groundwater

8.3.7 There are four categories of aquifer identified within the study area. The Sherwood Sandstone Group is classified as a Principal aquifer and the Mercia Mudstone Group as a Secondary B aquifer. Where present, alluvium, River Terrace Deposits and Glacialfluvial Sheet Deposits are classified as Secondary A aquifers. Head Deposits are classified as a Secondary (undifferentiated) aquifer.

8.3.8 The Proposed Scheme will pass through a total catchment groundwater source protection zone (SPZ) 3 from the southern end of the study area as far north as Hill Farm at Streethay. The study area will encroach on an outer SPZ 2 to the south-west of Hill Farm. The SPZ 3 and SPZ 2 relate to a groundwater abstraction point off Burton Old Road in the south-west of Streethay. The study area will also encroach on an inner SPZ 1 and outer SPZ 2 between A515 Lichfield Road and Hanch Farm to the south-east of Handsacre. These SPZs relate to a groundwater abstraction from the Sherwood Sandstone Group at Seedy Mill Water Treatment Works.

8.3.9 There are five licensed groundwater abstractions located within 1km of the limit of the land required for the construction of the Proposed Scheme, shown on Volume 5: Map Book – Land Quality, Map WR-02-22.

8.3.10 Further detail on the groundwater beneath the Proposed Scheme can be found in Section 13 Water resources and flood risk assessment.

Surface waters

8.3.11 The Proposed Scheme will cross the Wyrley and Essington Canal to the south of Cappers Lane. It will also cross the Trent and Mersey Canal three times, to the south-west of Fradley Wood and to the east of Ravenshaw Wood.

8.3.12 Mare Brook will be crossed by the Proposed Scheme to the west of Rough Stockings; Pyford Brook/Curborough Brook will be crossed to the north-west of Fradley Wood and Bourne Brook will be crossed to the south of John's Gorse.

8.3.13 There are also numerous ponds present within the study area.

8.3.14 Further information on surface waters is provided in Section 13 Water resources and flood risk assessment.

Current and historical land use

8.3.15 All potentially contaminated sites (identified from both current and historical land uses) are shown on Volume 5: Map Book – Land Quality, Maps LQ-01-061b to LQ-01-065. Each potentially contaminative land use is annotated on the maps using the code 22-XX, where 22 denotes the CFA number and XX denotes the individual site reference.

8.3.16 Current potentially contaminative land uses include Whittington Heath (Volume 5: Map Book – Land Quality, Map LQ-01-061b, A6), DMS Whittington (centred on Map LQ-01-061b, C3), the WCML (Map LQ-01-062, E6 and LQ-01-064, B7), the South Staffordshire Line (Map LQ-01-062, C6), a garage (Map LQ-01-061b, C6) and a metal works (Map LQ-01-064, E4).

8.3.17 Principal historical potentially contaminative land uses include an historical landfill to the south of Handsacre (Volume 5: Map Book – Land Quality, Map LQ-01-065, G6 and G7), a former tip to the south of the Trent and Mersey Canal (Map LQ-01-063, C7), a former airfield and military base at Fradley (centred on Map LQ-01-063, F5), and the partially infilled Wyrley and Essington Canal (Map LQ-01-062, F5).

8.3.18 The historical landfill at Lichfield Road, south of Handsacre, accepted industrial (pottery) waste between 1958 and 1960 and was subsequently developed as a residential area. Consultation with LDC revealed that the landfill was investigated under Part 2A of the Environmental Protection Act[31] and the investigations, completed in November 2010, concluded that the landfill is suitable for residential use and should not be declared contaminated land.

8.3.19 Other historical land uses identified within the study area with the potential to have caused contamination include several infilled pits, infilled ponds and infilled domestic water wells. All of these areas may have been manually infilled with a variety of waste materials and could also give rise to landfill gases such as methane, carbon dioxide and volatile organic compounds (VOC).

Other regulatory data

8.3.20 Regulatory data reviewed include pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences). A number of these have been recorded in the study area, the most notable being a former licensed waste management facility at Orchard Farm, located to the

[31] Her Majesty's Stationary Office (1990), Part IIA of the Environmental Protection Act.

north-east of Streethay approximately 200m to the east of the area of land required to construct the Proposed Scheme.

Mining/mineral resources

8.3.21 The Staffordshire and Stoke-on-Trent Minerals Local Plan 1994-2006[32] contains policies that seek to safeguard mineral resources against sterilisation from development.

8.3.22 There are no active mining or mineral sites or Preferred Areas[33] within the study area.

8.3.23 Three sand and gravel MCA are within the study area, two of which the Proposed Scheme will pass through. The first MCA, for sand and gravel processed from the Kidderminster Formation covers Whittington Heath at the south of this area (Volume 5: Map Book – Land quality, Map LQ-01-061b). The second MCA, for superficial sand and gravel derived from an area of Head deposits, just encroaches on the area of land required to construct the Proposed Scheme, to the north of Streethay (Volume 5: Map Book – Land Quality, Map LQ-01-062). The Proposed Scheme intersects a third, extensive MCA for superficial sand and gravel, relating to Glaciofluvial Sheet Deposits, from Gorse Farm in Fradley to the northern end of the study area (Volume 5: Map Book – Land Quality, Map LQ-01-063 to LQ-01-065).

8.3.24 Streethay sidings will not be located within any designated mineral sites.

Geo-conservation resources

8.3.25 There are no geo-conservation resources identified within the study area.

Receptors

8.3.26 The receptors that have been identified within this study area are summarised in Table 15.

Table 15: Summary of sensitive receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land contamination	People	Residents	High
		Workers	Moderate
	Controlled waters	Principal aquifers	High
		Secondary A aquifers	High
		Secondary B aquifers	Moderate
		Secondary (undifferentiated) aquifer	Moderate
		Canals	High
		Other surface watercourses and water bodies	Moderate

[32] Staffordshire County Council (1999), *Staffordshire and Stoke-on-Trent Minerals Local Plan 1994-2006*.
[33] Areas where mineral deposits are known to exist and where the County Council considers there would be least planning objection to mineral extraction taking place.

Issue	Receptor type	Receptor description	Receptor sensitivity
	Built environment	Buildings and property	Low to high
		Underground structures and services	Low
	Mineral resources	Bedrock sand and gravel MCA	Moderate
		Superficial sand and gravel MCA	Moderate
Impacts on mining/mineral sites (severance and sterilisation of mineral sites)	Mining/mineral sites	Bedrock sand and gravel MCA	Low
		Superficial sand and gravel MCA	Low

Future baseline

8.3.27 All committed development is described in Volume 5: Appendix CT-004-000. A committed development has been identified at DMS Whittington, an area which has been classified as an existing potentially contaminative land use. It involves redevelopment of the barracks with demolition of selected buildings. The EIA for that development identifies some areas of contamination and further remedial works required as part of the design and construction. The redevelopment in this area means there is the potential for an improvement in land quality and this has been considered in the assessment of DMS Whittington.

8.3.28 All other committed developments are either too far away from the Proposed Scheme to impact on land quality, or the developments would not alter the land use sufficiently to impact on the land quality baseline during either construction or operation of the Proposed Scheme.

8.4 Effects arising during construction

Avoidance and mitigation measures

8.4.1 The construction assessment takes into account the mitigation measures contained within the draft Code of Construction Practice (CoCP) (Volume 5: Appendix CT-003-000/1). The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme. Its requirements in relation to work in contaminated areas will ensure the effective management and control of the work. Such requirements include the following (Volume 5: Appendix CT-003-000/1):

- methods to control noise, waste, dust, odour gases and vapours (draft CoCP Sections 5, 7, 13 and 15);
- methods to control spillage and prevent contamination of adjacent areas (draft CoCP Section 5);
- the management of human exposure for both construction workers and people living and working nearby (draft CoCP Section 11);
- methods for the storage and handling of excavated materials (both contaminated and uncontaminated) (draft CoCP Sections 7 and 15);
- management of any unexpected contamination found during construction (draft CoCP Section 11);

- a post remediation permit to work system (draft CoCP Section 11);
- storage requirements for hazardous substances such as oil (draft CoCP Section 16); and
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect land quality during construction (draft CoCP, Section 5).

8.4.2 The draft CoCP requires that a programme of further investigations, which may include both desk based and site based work, will take place in order to confirm the full extent of areas of contamination and a risk assessment undertaken to determine what, if any, site specific remediation measures will be required to allow the Proposed Scheme to be constructed safely and to prevent harmful future migration of contaminants (draft CoCP, Section 11). The investigation and assessment of potentially contaminated sites will be undertaken in accordance with:

- Environment Agency CLR11 'Model Procedures for the Management of Land Contamination' (2004)[34]; and
- British Standard BS10175 'Investigation of Potentially Contaminated Sites' (2011)[35].

8.4.3 Where significant contamination is encountered, a remedial options appraisal will be undertaken to define the most appropriate remediation techniques. This appraisal will be undertaken based on multi-criteria attribute analysis that considers environmental, resource, social and economic factors in line with Sustainable Remediation Forum UK's publication A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (2010)[36]. The preferred option will then be developed into a remediation strategy, in consultation with regulatory authorities prior to implementation.

8.4.4 Contaminated soils excavated from the site, wherever feasible, will be treated as necessary to remove or render any contamination inactive and reused within the Proposed Scheme where needed and suitable for use. Treatment techniques are likely to include stabilisation methods, soil washing and bio-remediation to remove oil contaminants. Contaminated soil disposed of off-site would 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

8.4.5 The majority of the Proposed Scheme through this study area will be constructed on embankment, with areas of cutting at Whittington Heath and Whittington Common. The main construction features include Streethay sidings and viaduct and overbridge crossings of the various watercourses and roads.

[34] Environment Agency (2004), *CLR11 Model Procedures for the Management of Land Contamination.*
[35] British Standard BS10175 (2011), *Investigation of Potentially Contaminated Sites.*
[36] Sustainable Remediation Forum UK (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation.*

8.4.6 Construction works will include earthworks, utility diversions, deep foundations, temporary dewatering and other activities. In addition, road infrastructure works will also be required for the Proposed Scheme in the Whittington to Handsacre area.

8.4.7 Construction compounds for the Whittington to Handsacre area will be located at various points along the Proposed Scheme (Section 2.3). The compounds will include maintenance facilities for plant and machinery and fuel storage in bunded tanks.

Land contamination

8.4.8 In line with the assessment methodology, as set out in the SMR and SMR addendum, an initial screening process was undertaken (identified in the methodology as Stages A and B) 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. In total, 77 areas were considered during this screening process; 21 of these areas were taken forward to more detailed risk assessments (Stages C and D), in which the potential risks were assessed more fully. The majority of the areas undergoing the more detailed risk assessments were areas of infilled ground, former military land and existing railway lines. All areas assessed are shown on Maps LQ-01-061b to LQ-01-065 (Volume 5: CFA22) and those considered as potentially posing a risk to the Proposed Scheme are labelled with a reference number.

8.4.9 Conceptual site models (CSM) have been produced for the 21 areas taken to Stage C and D assessments. The detailed CSM are provided in Volume 5 (Appendix LQ 001-022, Section 3) and the results of the baseline risk assessments are summarised in this section. Potentially contaminated areas have been grouped and considered together, where appropriate. The following factors have determined the need for Stage C and D assessments:

- whether the area is within or beyond the area of land required for the construction of the Proposed Scheme or associated offline works; e.g. road realignments;
- the vertical alignment, i.e. whether the Proposed Scheme is in cutting or on embankment;
- the presence of underlying Principal or Secondary A aquifers or nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

8.4.10 A summary of the baseline CSM is provided in Table 16. The impacts and baseline risks quoted are before any mitigation is applied. The assessed baseline risk is based on the information provided at the time of the assessment. Where limited information is available, it is based on precautionary, worst case assumptions and may therefore report a higher risk than that which actually exists.

Table 16: Summary of baseline CSM* for sites which may pose a contaminative risk for the Proposed Scheme

Area ref.**	Area name (map)	Main potential impacts	Main baseline risk***
22-03	Infilled mill pond (LQ-01-062, G5)	Potential impact to human health off-site, controlled waters and property receptors.	Low
22-04	Infilled Wyrley and Essington Canal (LQ-01-062, F5)	Potential impact to human health off-site, controlled waters and property receptors.	Low
22-08	Airfield (centred on LQ-01-062, C6)	Potential impact to off-site human receptors, and groundwater.	Low
22-15	Infilled pond (LQ-01-062, B7)	Potential impact to off-site human receptors, groundwater and property receptors.	Low
22-18	Former airfield (centred on LQ-01-063, F5)	Potential impact to on-site human receptors, and groundwater.	Low
22-27	Former tip (LQ-01-063, C7)	Potential impact to groundwater and property receptors.	Low
22-38	Infilled pits (LQ-01-064, E8)	Potential impact to groundwater and property receptors.	Low
22-39	Infilled well (LQ-01-064, C7)	Potential impact to off-site human receptors, groundwater and property receptors.	Low
22-42 and 22-43	Infilled marl pits (LQ-01-064, C6 and B7 respectively)	Potential impact to off-site human receptors, groundwater and property receptors.	Low
22-44 and 22-45	Infilled ponds (LQ-01-064, B7)	Potential impact to off-site human receptors, groundwater and property receptors.	Low
22-46	Historical landfill (LQ-01-065, G6 and G7)	Potential impact to groundwater.	Moderate/low
22-47	Infilled pit (LQ-01-065, F6)	Potential impact to off-site human receptors, groundwater and property receptors.	Low
22-48	Whittington Heath (centred on LQ-01-061b, A6)	Potential impact to on-site and off-site human receptors and groundwater.	Low
22-49	DMS Whittington (centred on LQ-01-061b, C3)	Potential impact to on-site and off-site human receptors and groundwater.	Low
22-51	Garage**** (LQ-01-061b, C6)	Potential impact to on-site human receptors, and groundwater.	Low
22-58, 22-61 and 22-70	Existing railway lines: WCML (LQ-01-062, E6 and LQ-01-064, B7) South Staffordshire Line (LQ-01-062,C6)	Potential impact to off-site human receptors and groundwater.	Low
22-72	Metal works (LQ-01-064, E4)	Potential impact to on-site and off-site human receptors and groundwater.	Low

*CSM have been prepared as part of the detailed land contamination methodology (refer to Volume 5) for baseline, construction and post-construction

** Each area is assigned a unique identification number (see Volume 5, Appendix LQ-001-022).

*** The moderate risks identified reflect the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported high or moderate existing baseline risk in the absence of site investigation a precautionary, worst case risk is reported in the table.

**** This area is immediately to the south of the southern boundary of the Whittington to Handsacre area but is included as it is within the 250m buffer forming the study area.

Temporary effects

8.4.11 An assessment of the effects of contamination has been undertaken by comparing the CSM developed for potential contaminated areas at baseline, construction and post construction stages. The baseline and construction CSM have been compared to assess effects at the construction stage.

8.4.12 Table 17 presents the summary of the construction effects obtained from a comparison of the baseline and construction impacts. The construction risk assessment has taken into account the requirements of the draft CoCP to which construction will adhere. The details of these comparisons are presented in Volume 5 (Appendix LQ 001-022).

8.4.13 The baseline and construction CSM have been compared to determine the change in level of risk to receptors during the construction stage, and thus to define the level of effect at the construction stage. 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 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 construction boundary.

Table 17: Summary of temporary (construction) effects

Area ref.	Area name (map)	Main baseline risk	Main construction risk*	Temporary effect and significance
22-03	Infilled mill pond (LQ-01-062, G5)	Low	Moderate/low (groundwater)	Negligible – Minor adverse (not significant)
22-04	Infilled Wyrley and Essington Canal (LQ-01-062, F5)	Low	Moderate/low (groundwater)	Negligible – Minor adverse (not significant)
22-08	Airfield (centred on LQ-01-062, C6)	Low	Moderate/low (groundwater)	Negligible – Minor adverse (not significant)
22-15	Infilled pond (LQ-01-062, B7)	Low	Low	Negligible (not significant)
22-18	Former airfield (centred on LQ-01-063, F5)	Low	Moderate/low (groundwater)	Negligible– Minor adverse (not significant)
22-27	Former tip (LQ-01-063, C7)	Low	Low	Negligible (not significant)
22-38	Infilled pits (LQ-01-064, E8)	Low	Low	Negligible (not significant)
22-39	Infilled well (LQ-01-064, C7)	Low	Low	Negligible (not significant)
22-42 and 22-43	Infilled marl pits (LQ-01-064, C6 and B7 respectively)	Low	Low	Negligible (not significant)
22-44 and 22-45	Infilled ponds (LQ-01-064, B7)	Low	Low	Negligible (not significant)

Area ref.	Area name (map)	Main baseline risk	Main construction risk*	Temporary effect and significance
22-46	Historical landfill (LQ-01-065, G6 and G7)	Moderate/Low	Moderate/low	Negligible (not significant)
22-47	Infilled pit (LQ-01-065, F6)	Low	Moderate/low	Negligible – Minor adverse (not significant)
22-48	Whittington Heath (centred on LQ-01-061b, A6)	Low	Moderate/low (groundwater)	Negligible– Minor adverse (not significant)
22-49	DMS Whittington (centred on LQ-01-061b, C3)	Low	Low	Negligible (not significant)
22-51	Garage (LQ-01-061b, C6)	Low	Moderate/low (groundwater)	Negligible– Minor adverse (not significant)
22-58, 22-61 and 22-70	Existing railway lines: WCML (LQ-01-062, E6 and LQ-01-064, B7) South Staffordshire Line (LQ-01-062,C6)	Low	Moderate/low (groundwater)	Negligible– Minor adverse (not significant)
22-72	Metal works (LQ-01-064, E4)	Low	Low	Negligible (not significant)

* The low/moderate main construction risk identified in the above table does not necessarily imply an unacceptable risk. Application of the processes and measures within the CoCP will ensure that site risks during the construction stage are controlled.

8.4.14 Table 17 indicates that based upon the assessment, no significant effects have been identified during the construction phase in relation to potential land contamination. However, temporary risks to groundwater have been identified from the following potential sources of contamination:

- an infilled mill pond which will be intersected by the Proposed Scheme or disturbed during construction
- an infilled section of the disused Wyrley and Essington Canal which will be crossed by the Proposed Scheme on viaduct;
- two areas of airfields/ former military land which will be intersected by the Proposed Scheme;
- an infilled pit which will be intersected during construction by an access road relating to the Proposed Scheme;
- Whittington Heath which will be intersected by the Proposed Scheme;
- a garage which will be intersected by the Proposed Scheme; and
- WCML and South Staffordshire Line which will be crossed by the Proposed Scheme.

8.4.15 These risks relate to the temporary mobilisation of contaminants during construction potentially allowing an increase in migration of contaminants to groundwater. The risks are assessed as temporary minor adverse effects.

8.4.16 Construction compounds located in this study area will include staff welfare facilities, maintenance facilities for plant and machinery and fuel storage in bunded tanks. Construction compounds will store and use potentially contaminative materials such as fuels, oils and solvents, and the measures outlined in the draft CoCP will manage risks from the storage of such materials.

8.4.17 The main and satellite construction compounds may also be used for temporary storage of potentially contaminated soils. The mitigation measures outlined in the draft CoCP will manage potential risks from the storage of such materials. The location of these construction compounds is given in Section 2.3.

8.4.18 It is considered unlikely that additional remediation works will be required over and above the mitigation measures contained as standard within the draft CoCP.

8.4.19 There are anticipated to be no significant cumulative temporary effects from construction.

Permanent effects

8.4.20 Baseline and post-construction CSM have been compared to assess the permanent (post-construction) effects. The post-construction CSM assumes that all the required remediation has been carried out and validated.

8.4.21 Table 18 includes 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 these comparisons are presented in Volume 5 (Appendix LQ-001-022).

Table 18: Summary of permanent (post-construction) effects

Area ref.	Area name (map)	Main baseline risk	Main post-construction risk	Post-construction effect and significance
22-03	Infilled mill pond (LQ-01-062, G5)	Low	Low	Negligible (not significant)
22-04	Infilled Wyrley and Essington Canal (LQ-01-062, F5)	Low	Low	Negligible (not significant)
22-08	Airfield (centred on LQ-01-062, C6)	Low	Low	Negligible (not significant)
22-15	Infilled pond (LQ-01-062, B7)	Low	Low	Negligible (not significant)
22-18	Former airfield (centred on LQ-01-063, F5)	Low	Low	Negligible (not significant)
22-27	Former tip (LQ-01-063, C7)	Low	Low	Negligible (not significant)
22-38	Infilled pits (LQ-01-064, E8)	Low	Low	Negligible (not significant)
22-39	Infilled well (LQ-01-064, C7)	Low	Low	Negligible (not significant)
22-42 and 22-43	Infilled marl pits (LQ-01-064, C6 and B7 respectively)	Low	Low	Negligible (not significant)

Area ref.	Area name (map)	Main baseline risk	Main post-construction risk	Post-construction effect and significance
22-44 and 22-45	Infilled ponds (LQ-01-064, B7)	Low	Low	Negligible (not significant)
22-46	Historical landfill (LQ-01-065, G6 and G7)	Moderate/Low	Moderate/low	Negligible (not significant)
22-47	Infilled pit (LQ-01-065, F6)	Low	Very low	Negligible – Minor beneficial (not significant)
22-48	Whittington Heath (centred on LQ-01-061b, A6)	Low	Low	Negligible (not significant)
22-49	DMS Whittington (centred on LQ-01-061b, C3)	Low	Low	Negligible (not significant)
22-51	Garage*** (LQ-01-061b, C6)	Low	Very low	Negligible – Minor beneficial (not significant)
22-58, 22-61 and 22-70	Existing railway lines: WCML (LQ-01-062, E6 and LQ-01-064, B7) South Staffordshire Line (LQ-01-062,C6)	Low	Low	Negligible (not significant)
22-72	Metal works (LQ-01-064, E4)	Low	Low	Negligible (not significant)

8.4.22 The magnitude of the permanent effects and their significance have been determined by calculating 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 construction boundary.

8.4.23 Table 18 shows that the Proposed Scheme results in either a reduction or no change in the level of risk already existing at each site for both on site and off site receptors.

8.4.24 As an example of a beneficial effect, the infilled pit which lies on the route of an access road of the Proposed Scheme, will be removed during construction.

8.4.25 There are anticipated to be no significant cumulative permanent effects.

Mining/mineral resources

8.4.26 Construction of the Proposed Scheme has the potential to impact existing mineral resources. This could occur by sterilisation of the resource, direct excavation during construction of the Proposed Scheme or through temporary and/or permanent severance[37] that may occur during the construction phase of the Proposed Scheme, possibly continuing through to the operation.

[37] 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.

Temporary effects

8.4.27 Temporary adverse effects are anticipated on MCA where land will be temporarily used for construction and returned to the landowner after construction. In the Whittington to Handsacre area this includes satellite construction compounds and earthworks stockpiling. There are temporary areas of earthworks stockpiling on Whittington Heath within the MCA. Construction compounds are proposed to the north of Little Lyntus Wood, at the Trent and Mersey Canal crossings, A515 Lichfield Road and at Harvey's Rough overlying the superficial sand and gravel MCA between Gorse Farm and the northern edge of the CFA.

8.4.28 There are no temporary effects anticipated on the superficial sand and gravel MCA located to the north of Streethay.

8.4.29 Table 19 presents a summary of the assessment of temporary effects on the mining and mineral resources identified. As the earthworks stockpiles and construction compounds cover a very small area of the MCA for a temporary period the magnitude of impact is assessed as minor.

Table 19: Summary of temporary effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area of land underlying Whittington Heath LQ-01-061b	Mineral Consultation Area.	Mineral Consultation Area for bedrock sand and gravel extraction.	Low	Minor	Negligible (not significant)
Area of land between Gorse Farm and northern edge of the proposed Scheme in the study area LQ-01-063 to 065	Mineral Consultation Area.	Mineral Consultation Area for superficial sand and gravel extraction.	Low	Minor	Negligible (not significant)

8.4.30 No significant temporary effects are anticipated on the existing mineral resource.

Permanent effects

8.4.31 The Proposed Scheme will be constructed on embankment through the two sand and gravel MCAs that will be crossed, as shown in Volume 5: Map LQ-01-061b and 063. There is a potential minor adverse impact but the effect is assessed as not significant because there will only be a minor severance or sterilisation of a large local resource.

8.4.32 Table 20 presents a summary of the assessment of effects on the mining and mineral resources identified.

Table 20: Summary of effects for mining and mineral resources

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area of land underlying Whittington Heath LQ-01-061b	Mineral Consultation Area	The Mineral Consultation Area will be intersected by the Proposed Scheme. It is a localised resource for bedrock derived sand and gravel extraction.	Low	Moderate	Minor adverse (not significant)

Site name	Status	Description	Sensitivity/ value	Magnitude of impact	Effect and significance
Area of land underlying north of Streethay LQ-01-062	Mineral Consultation Area	The Mineral Consultation Area just encroaches on the study area and will not be intersected by the Proposed Scheme. It is a localised resource for superficial sand and gravel extraction.	Low	Minor	Negligible (not significant)
Area of land between Gorse Farm and northern edge of the Proposed Scheme in the study area LQ-01-063 to 065	Mineral Consultation Area	The Mineral Consultation Area will be intersected by the Proposed Scheme and is an extensive resource for superficial sand and gravel extraction.	Low	Moderate	Minor adverse (not significant)

8.4.33 There are anticipated to be no significant permanent effects from operation on the mineral resources.

8.4.34 The cumulative effects on mineral resource across the whole of the Proposed Scheme are discussed in the assessment of route wide effects presented in Volume 3.

Geo-conservation resources

8.4.35 No geo-conservation areas such as SSSI or LGS are present in the study area.

Other mitigation measures

8.4.36 At this stage, no additional mitigation measures are considered necessary to mitigate risks from land contamination at the construction phase beyond those set out in the draft CoCP and instigated as part of required remediation strategies.

8.4.37 Mitigation of the effects on mineral resources can include prior extraction of the resource for use within the project or elsewhere. Extraction may be limited to landscaped areas within the Proposed Scheme adjacent to rather than beneath the trackbed, which will require good founding conditions. A plan will be discussed and agreed in advance of the construction works with the landowner, the mineral planning department at SCC and any other interested parties to assist in achieving an effective management of minerals within the affected location of the MCA.

Summary of likely residual significant effects

8.4.38 No likely residual significant effects are anticipated with the application of the mitigation measures described.

8.5 Effects arising from operation

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

Avoidance and mitigation measures

8.5.2 Maintenance and operation of the Proposed Scheme will be in accordance with environmental legislation and good practice whereby appropriate spillage and pollution response procedures will be established.

Assessment of impacts and effects

8.5.3 Cappers Lane auto-transformer station will be situated to the north of Cappers Lane, and Lyntus auto-transformer station will be situated north of Wood End Lane. Mare Brook package substation will be situated north of Mare Brook. An auto-transformer substation can, in principle, be a source of contamination through accidental discharge or leaks of coolant. However, the proposed auto-transformer substations and package substations, in common with other modern substations, will use secondary containment appropriate to the level of risk.

8.5.4 The operation of the trains may give rise to minor contamination through leakage of hydraulic or lubricating oils. However, such leakage or spillage is expected to be very small and unlikely to result in significant contamination.

8.5.5 It is unlikely that there will be any cumulative effects on land quality of in-combination effects on receptors because of the environmental controls that will be placed on operational procedures.

Other mitigation measures

8.5.6 No other mitigation measures are expected beyond what has already been outlined relating to land quality in the Whittington to Handsacre study area.

8.5.7 There may be ongoing monitoring requirements following remediation works carried out during construction. Such monitoring, including monitoring of groundwater quality or ground gas, could extend into the operational phase of the Proposed Scheme.

Summary of likely residual significant effects

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

9 Landscape and visual assessment

9.1 Introduction

9.1.1 This section reports the assessment of the likely significant landscape and visual effects. It starts by summarising the baseline conditions found within and around the route of the Proposed Scheme and goes on to describe the significant effects that will arise during construction and operation on landscape character areas (LCAs) and visual receptors.

9.1.2 In this section, the operational assessment section refers not just to the running of the trains but also the presence of the new permanent infrastructure associated with the Proposed Scheme.

9.1.3 Principal landscape and visual issues in the area include:

- temporary effects to LCAs and visual receptors during construction arising from the presence of construction plant, worksites, removal of existing vegetation and severance of agricultural land and construction of design elements of the Proposed Scheme; and
- permanent landscape and visual effects during operation arising from the presence of new engineered landforms cutting across the existing landscape, new viaducts, noise fence barriers, highway infrastructure, overhead line equipment and regular passing of high speed trains. In the main, permanent adverse effects will reduce over time as planting established as part of the Proposed Scheme matures.

9.1.4 A separate but related assessment of effects on the setting of heritage assets is included in Section 6. Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in Volume 5: Appendix LV-001-022, which comprises the following:

- Part 1 — Engagement with technical stakeholders;
- Part 2 — Environmental baseline report;
- Part 3 — Assessment matrices; and
- Part 4 — Schedule of non-significant effects.

9.1.5 The extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages has been discussed with Staffordshire County Council (SCC) and Lichfield District Council (LDC). Summer field surveys, including photographic studies of LCAs and visual assessment of viewpoints, were undertaken from May to July 2012 and from May to June 2013. Winter surveys were undertaken from December 2012 to March 2013.

9.2 Scope, assumptions and limitations

9.2.1 The assessment scope, key assumptions and limitations for the landscape and visual assessment are set out in Volume 1, the SMR (Volume 5: Appendix CT-0001-000/1)

and the SMR Addendum (Volume 5: Appendix CT-0001-000/2). This report follows the standard assessment methodology.

9.2.2 The study area has been informed by the construction and operational phase zones of theoretical visibility (ZTV), which are shown in Volume 5, Maps Book — Landscape and visual assessment, Maps LV-07-92b to LV-07-97 and LV-08-92b to LV-08-97. The ZTV has been produced in line with the methodology described in the SMR Addendum (Volume 5: Appendix CT-001-000/2), and is an indication of the theoretical visibility of the Proposed Scheme. In some locations, lack of data on vegetation cover may mean the actual visibility is substantially less than that shown in the ZTV. Tall construction plant (e.g. cranes and piling rigs) are excluded from the ZTV for the construction phase and overhead line equipment is excluded from the ZTV for the operational phase, but these are described and taken into account in the assessment of effects on landscape character areas and visual receptors

9.2.3 LCAs and visual receptors within approximately 2km of the Proposed Scheme have been assessed.

Limitations

9.2.4 During the baseline survey there were some areas which 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.

9.3 Environmental baseline

Existing baseline

Landscape baseline

9.3.1 A raised heath plateau at Whittington slopes gently northwards, down to the River Trent terraces, skirting east of Lichfield's well defined edge. North of Lichfield, the land rises towards the Cannock Chase and Cank Hills. The rural landscape is predominantly arable with some pasture, equestrian uses and market gardening with polytunnels. Villages, hamlets and isolated properties are linked by a network of minor roads. The Trent and Mersey Canal is used primarily for recreation. North-east of Lichfield, Fradley Industrial Area is prominent. Lichfield Cathedral and Close is the area's principal historic element, with the Cathedral's three spires forming a prominent landmark on the skyline in the rural areas south and east of the city.

9.3.2 The dominant pattern in the landscape is of medium to large fields enclosed by dense, well maintained hedgerows and narrow tree belts. There are larger woodlands around Whittington, north-west of Fradley and south-east of Lichfield, including the A38 corridor. At Curborough, smaller well-hedged fields, tree belts and varied landform creates a more intimate landscape. The A38 is the primary road, with the A51 linking Lichfield and Tamworth and the M6 Toll. The WCML crosses the western part of the area. A network of lanes and PRoW, including the Heart of England Way, provide access to the countryside.

9.3.3 The LCAs within the area have been identified through reference to the SCC Supplementary Planning Guidance (SPG) document 'Planning for Landscape Change,'[38] and confirmed through desk studies and field work.

9.3.4 Descriptions of all LCAs are provided in Volume 5: Appendix LV-001-022 Part 2. For the purposes of this assessment the study area has been sub-divided into five discrete LCA. A summary of these LCAs is provided below. The LCAs are shown in Volume 5: Map Book — Landscape and visual assessment, Maps LV-02-092b to LV-02-097.

Sandstone Outer Estatelands LCA

9.3.5 This LCA comprises a landscape of small villages and isolated cottages set in a regular pattern of large arable hedged or open fields. Landform is gently undulating, with limited hedgerows and few hedgerow trees. In pastoral areas, gapped hedgerows are important landscape features. The overall landscape condition is fair and the survival of scarce semi-natural heathland, such as at Whittington Heath, is critical to maintaining character and quality. The landscape includes some large modern farm buildings, powerlines, recent housing developments and busy main roads, resulting in a medium level of tranquillity. This landscape is of local value due to the extensive network of PRoW and the setting it provides for the Heart of England Way. Therefore, this area has a medium sensitivity to change.

Settled Farmland LCA

9.3.6 This LCA comprises an undulating rural landscape with a good sense of enclosure. Land use is arable with a range of field sizes, with poorly-maintained hedgerows. Small, infrequent woodlands are linked by a network of narrow winding lanes, often bordered by hedgebanks and leading to clustered farmsteads. The PRoW network provides good access to the rural areas. There are increasing development pressures on villages with farm diversification, residential expansion and busy traffic on lanes. The overall landscape condition is fair. Night-time lighting in Lichfield and Fradley Industrial Area is evident. The A38 corridor is prominent, but minor roads lined by hedgerows are more discrete, resulting in a medium level of tranquillity. This LCA is of district value, due to the presence of designated green belt between Lichfield and Armitage with Handsacre. Therefore, this area has a medium sensitivity to change.

Settled Heathlands LCA

9.3.7 This LCA comprises a landscape of mixed farming in a regular pattern of hedged fields with dispersed settlements. Bracken and birch in woodlands and hedgerows reveal the area's heathland origins. Overall landscape condition is fair due to relatively sparse hedgerows and increasing urbanisation. Land uses are diverse and include part of Fradley Industrial Area and a popular recreational section of the Trent and Mersey Canal. There is little night-time lighting other than from Fradley Industrial Area. Major transport routes include the A515 and the existing WCML. The presence of Fradley and some busy roads, results in a medium level of tranquillity. This LCA is considered to be of district value due to the presence of canal-related tourist attractions and network of PRoWs. Therefore, this area has a medium sensitivity to change.

[38] Staffordshire County Council Development Services Department (2000), *Supplementary Planning Guidance 'Planning for Landscape Change'*.

Terraced Alluvial Lowlands LCA

9.3.8 The land within this LCA is generally flat with a well-wooded landscape of intensive arable and improved pasture. Fields are well-hedged with good tree cover and commonly large scale, with areas of older, smaller irregularly-shaped fields including polytunnels at Handsacre, with a network of straight roads and lanes that links farms and villages. The overall landscape condition is good. Night-time lighting is noticeable on the unscreened eastern edge of Handsacre. Traffic on the A515 Lichfield Road and the B5014, Lichfield Road into Handsacre results in a medium level of tranquillity. The LCA is considered to be of value at a local level for its rural setting and access to PRoW. Therefore this area has a medium sensitivity to change.

Visual baseline

9.3.9 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-022 Part 2. A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are shown in Volume 2, CFA22 Map Book, Maps LV-07-92b to LV-07-97 and LV-08-92b to LV-08-97. The viewpoints are numbered to identify their locations. In each case, the middle number (xxx.X.xxx) identifies the type of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and Healthcare, 6: Employment and 7: Sports.

9.3.10 No protected views have been identified within the study area.

9.3.11 Residential receptors have a high sensitivity to change and include scattered farmsteads and individual properties and villages including Whittington and DMS Whittington, Huddlesford, Streethay and Armitage with Handsacre, as well as properties on the eastern edge of Lichfield. Views are typically across agricultural land. The combination of flat or gently undulating topography with well-treed hedgerows, small copses and woodland belts creates a diverse range of views, which vary in the distance and field of view available.

9.3.12 Recreational receptors, also with a high sensitivity to change, are located on PRoW throughout the study area, including the Heart of England Way and the Trent and Mersey Canal. Viewpoints are typically in rural locations, with fields or woodlands forming the surroundings, with a varying degree of enclosure dependant on landform and surrounding vegetation.

9.3.13 Viewpoints from roads generally include the network of minor roads that cross this area; these have a medium sensitivity to change. People travelling on main roads, including the A38, A515 and A51 have a low sensitivity to change. In general, views from the road network are characterised by arable and grazing land, with some polytunnels, but also include the edges of urban settlements at Lichfield, Fradley and Streethay.

9.3.14 Employment receptors include people at places of work, such as within Fradley Industrial Area, are the least sensitive receptors as their attention is likely to be focused on their work activity. These receptors have a low sensitivity to change.

Future baseline

9.3.15 A summary of the committed developments which are assumed to be built and occupied prior to either the construction of operation of the Proposed Scheme is provided below, along with the consequential effect on the character of LCAs and nature of views. Developments which would introduce new visual receptors which may be significantly affected are also described. These developments are shown in Volume 5, Map Book — Cross topic, Maps CT-13-061 to CT-13-065.

Construction (2017)

9.3.16 Section 2.1 provides details of the committed development proposals which are assumed to have been implemented by 2017. Where planning permission for these developments include the implementation of a landscape scheme, any new planting will not be established by the time construction commences for the Proposed Scheme and as such will not provide any intermediate screening between the new developments and the construction of the new railway which will commence in 2017. Therefore, the sensitivity of each of the areas affected by proposed developments listed below will be unchanged for the assessment of affects during construction:

- DMS Whittington, Tamworth Road – Regimental Headquarters of the Mercian Regiment. This development includes demolition of selected buildings and redevelopment to create a mixed use military base comprising education and training, office, storage and museum with ancillary residential and recreational/ social accommodation and related access, servicing and landscaping;
- DMS Whittington, Tamworth Road – Defence Medical Services. Improvements to existing grass sports pitches and installation of synthetic sports pitch including erection of fencing and column floodlighting;
- Whittington Hill Farm, Darnford Lane; conversion of workshops/stables to form 3 bedroom ancillary residential unit;
- land for development of a canal-side marina including 130 moorings, service and toilet facilities access and landscaping east of the Coventry Canal at Streethay Farm, off Broad Lane, Huddlesford;
- land for employment development Burton Old Road, Lichfield; erection of business units of varying heights;
- land for employment development at Easthill Farm, Wood End Lane; erection of small and medium scale business units of varying heights;
- land at Fradley Park/ Halifax Avenue/Wood End Lane; erection of business units of varying heights and associated works; and
- Hanch Hall Farm, B5014 Lichfield Road, Handsacre; erection of a livestock, produce and implement store.

Operation (2026)

9.3.17 Section 2.1 identifies the projects that form part of the future baseline for operation. The sensitivity of the LCA's will remain as per the baseline assessment, although new

visual receptors will be present. Planting at employment sites will have established sufficiently to partially filter views to the Proposed Scheme, and will continue to be valid receptors during the operational phase.

9.4 Temporary effects arising during construction

9.4.1 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 which cannot be mitigated practicably. Such effects are temporary and vary over the construction period depending on the intensity and scale of the works at the time. The assessment of landscape and visual effects has been based on the activities occurring during the peak construction phase, which is defined as the period during which the main civil engineering works will take place, including establishment of compounds, main earthworks and structure works. The effects associated with the peak construction phase in this CFA will generally be considered to be long term given the construction programme (see Section 2.3).

9.4.2 Overall, civil engineering works in this CFA will be undertaken between the start of 2017 and the end of 2023. The Cappers Lane main compound will be in place for approximately six years, the A515 Lichfield Road underbridge main compound for approximately five years and six months and the Handsacre main compound (rail systems) for approximately five years and six months. Satellite compounds will be in place for between approximately one and three years and six months, with the exception of the Curborough Flyover satellite compound, which will be in place for approximately seven years during the civil engineering works phase. Effects during other phases of works are likely to be lesser due to less construction equipment being required at the time and a reduced intensity of construction activity.

9.4.3 The construction works that have been taken into account in determining the effects on landscape and visual receptors include:

- construction of a cutting north of the A51 Tamworth Road at Whittington Heath Golf Club;
- construction of Lichfield Road, Whittington underbridge and embankment;
- construction of Darnford Lane overbridge;
- construction of Cappers Lane viaduct and embankment;
- construction of Broad Lane embankment and underbridge;
- use of land near Broad Lane for satellite compounds;
- construction of Fulfen Wood viaduct over WCML;
- construction of the Fulfen Farm embankment and viaduct crossing the South Staffordshire Railway Line and A38;
- use of land south of the A38 for soil storage/ material transfer;
- use of land south of the South Staffordshire Line/ A38 for construction sidings;
- use of land near A38 for Cappers Lane compound and temporary workers'

accommodation;

- construction of Fradley embankment;
- realignment of Wood End Lane;
- construction of Curborough flyover;
- construction of embankments and the Trent and Mersey Canal east and west viaducts and Pyford Brook viaduct between Fradley and Wood End;
- use of land near Trent and Mersey Canal for satellite compounds and materials transfer stockpiles;
- construction of Bourne Brook viaduct;
- construction of a compound, temporary workers' accommodation and material transfer stockpiles at Shaw Lane;
- construction of Harvey's Rough embankment;
- construction of Harvey's Rough flyover and WCML tie-in;
- general construction activity including demolitions, earthworks (including topsoil stripping and stockpiling), temporary haul roads (10m wide alongside the earthworks footprint), formation of batters and profiling, piling and formation of structures and security fencing;
- general construction plant, equipment and associated infrastructure including cranes, batching plants; and
- temporary road and PRoW diversions and closures.

Avoidance and mitigation measures

9.4.4 Measures that have been incorporated into the draft CoCP to avoid or reduce landscape and visual effects during construction include the following (see Volume 5: Appendix CT-003-000/1):

- maximising the retention and protection of existing trees and vegetation where possible (draft CoCP Section 12);
- use of well-maintained hoardings and fencing (draft CoCP Section 5);
- designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses (draft CoCP Section 5);
- replacement of any trees intended to be retained which may be accidentally felled or die as a consequence of construction works (draft CoCP Section 12);
- appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed (draft CoCP Section 12); and
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect landscape and visual resources during construction (draft CoCP Section 5).

9.4.5 These measures have been taken account of in the assessment of the construction effects below.

Assessment of temporary impacts and effects

9.4.6 The most apparent changes to landscape character and viewpoints during construction will relate to the temporary presence of construction plant and the removal of existing landscape elements, such as trees, hedgerows and agricultural land. Changes will be most notable along the embankments through the landscape between Whittington Heath and Handsacre. The construction of viaducts across lower-lying land at Cappers Lane, Fulfen Wood/ WCML, Streethay, Trent and Mersey Canal (east and west), Pyford Brook, Bourne Brook and Harvey's Rough will be key issues as will road realignments and the Darnford Lane overbridge. The height of the construction plant and viaducts and the close proximity of construction activities to viewpoints, coupled with the absence of intervening screening (apart from the site hoardings) will result in significant visual effects during construction. The landform in certain locations (e.g. the A38 embankments) and the retention of intervening hedgerows and trees will partially screen low level construction activity.

Landscape assessment

9.4.7 The following section describes the likely significant effects on LCAs during construction. All LCAs within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-022 Part 4.

Sandstone Outer Estatelands LCA

9.4.8 The Proposed Scheme will pass though the Sandstone Outer Estatelands LCA from the boundary with CFA21 along the A51 at Whittington Heath Golf Club, to the WCML. Part of this LCA is within the adjoining CFA21. Construction will require the removal of trees and woodland and will result in some loss and severance of agricultural land. Whittington Heath Golf Club clubhouse on the existing A51 alignment will be demolished. Vegetation removal will cause further fragmentation in areas where hedgerows are scarce, whilst in more secluded areas openness will be increased and tranquillity reduced due to construction activity, night-time lighting and increased traffic.

9.4.9 Areas of scarce, semi-natural heathlands at Whittington Heath Golf Club will be removed which will impact on the LCA's character. North of Lichfield Road, Whittington, embankment and viaduct construction crossing gently sloping land and flood plain at Cappers Lane and a canal undergoing restoration will be at variance with the local character of the LCA. Temporary diversions of local lanes and PRoW will be needed. Incongruent construction activities, including worksites along the route within the LCA and temporary workers accommodation and material transfer stockpiles located between the WCML and Cappers Lane will occur throughout the construction period. In CFA21 the character of this area will be substantially altered through the removal of vegetation and the introduction of new infrastructure. Therefore, due to the changes in setting within this CFA, and the changes in character described in CFA21, the magnitude of change will be high. The high magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a major adverse effect.

Settled Farmlands LCA

9.4.10 The Proposed Scheme will pass through this LCA from the WCML to Wood End Lane at Fradley. Construction activities will result in the loss of hedgerows and trees within the Proposed Scheme, including the west block of Fulfen Wood. Residential and agricultural buildings at Hill Farm, Streethay and agricultural buildings at Streethay Farm will be demolished. There will also be temporary loss of agricultural land and disruption of field use. The construction of embankments and viaducts together with construction sidings, a worksite and extensive areas of material transfer stockpiles south of the South Staffordshire Railway Line/A38 will result in changes to the existing character of the LCA in this area, urbanising agricultural land south and east of Streethay and Fradley. Lighting at worksites and the construction sidings will be noticeable despite the proximity to A38 vehicle and slip road lighting. Fradley embankment construction will form a new western edge to future development at Fradley Industrial Area, narrowing the rural area separating Lichfield and Fradley. The character of the area will also be affected by the realignment of Wood End Lane, temporary diversions and/or closures of some local lanes and PRoW. Traffic on local lanes will increase with an overall, temporary reduction in tranquillity. The magnitude of change to the LCA will be high. The high magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Settled Heathlands LCA

9.4.11 The Proposed Scheme will cross the Settled Heathlands LCA from Wood End Lane at Fradley to Ashton Hays Farm, south of Handsacre. There will be localised loss of hedgerows, trees and areas of woodland at Fradley, Fradley Wood and Ravenshaw Wood, which are distinctive of this LCA. There will also be loss of agricultural land and temporary disruption of field access. The character of the area will be affected by the construction of large scale earthworks and viaducts over the Trent and Mersey Canal, cutting through canalside woods, affecting the canal conservation area and recreation, and reducing seclusion and tranquillity.

9.4.12 Construction-related traffic will be notable in certain areas, which will be out of character with the working rural and recreational landscape. There will be temporary diversions and/or closures of some lanes and PRoW, including Sustrans National Cycleway Route No. 54. Construction worksites and lighting, particularly in rural areas will extend the urbanising influence of Fradley Industrial Area and reduce local tranquillity. Overall, therefore the magnitude of change will be high. The high magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a major adverse effect.

Visual assessment

9.4.13 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken during winter, 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. Representative viewpoints within the study area considered to experience a

non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-022 Part 4.

9.4.14 The number identifies the viewpoint locations which are shown in Volume 5: Map Book — Landscape and visual assessment, Maps LV-07-92b to LV-07-97. In each case, the middle number (xxx.X.xxx) identifies the type of receptor present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and Healthcare, 6: Employment and 7: Sports.

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

Viewpoint 347.2.002: View north-east from South Lodge, on the A51, Tamworth Road

9.4.16 Construction activities will be visible approximately 100m away from this viewpoint across the existing A51 Tamworth Road, beyond woodland belts at Whittington Heath Golf Club. Visual impacts will include the removal of a section of mature roadside trees for the temporary realignment of the A51, and of areas of woodland with the golf course along the route.

9.4.17 Construction plant for the cutting beneath the A51, the temporary realignment of the road closer to the property and its subsequent reconstruction on the original alignment will be prominent in the foreground, as will the construction of a package substation and access track north of the A51. A new farm access track from the A51 will be visible to the side of the viewpoint. A satellite compound east of the route will be visible in the middle ground, partially screened by temporary storage stockpiles along the top of the cutting. Overall, the magnitude of change is considered to be high.

9.4.18 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 347.4.007: View north-east from Lichfield Road, Whittington

9.4.19 Construction activities will be visible in the middle ground, approximately 700m away from this viewpoint. The removal of hedgerows and trees and the presence of construction plant required for the embankment north of Whittington Heath and for the Darnford Lane overbridge over a shallow cutting will be visible. Construction activities visible in the background will include the formation of embankments and viaducts crossing sloping land north of Darnford Lane. The works and plant movements will be incongruous features across a broad arc of view, seen in the middle ground and background, beyond intervening vegetation resulting in a medium magnitude of change.

9.4.20 The medium magnitude of change when assessed alongside a medium sensitivity of receptor will result in a moderate adverse effect.

Viewpoints 348.2.002 and 348.3.003: Views north-west from Thimble Hall Cottage and PRoW Whittington Footpath 17, Sandy Lane

9.4.21 Construction activities will be approximately 300m and 900m away from these viewpoints. The removal of hedgerows and trees along the route between Whittington Common Road and Darnford Lane will be visible across a narrow arc in the middle ground. Construction plant required for the formation of the embankment south of Ellfield House and for the cutting and overbridge at Darnford Lane will be noticeable, on gently rising ground between woodland at Whittington Heath and trees at Ellfield House. Further north, the upper sections of cranes and piling rigs for the construction of the Cappers Lane viaduct will be partially visible in the background, screened by rising topography and intervening vegetation, therefore the magnitude of change will be medium.

9.4.22 The medium magnitude of change, assessed alongside the high sensitivity of the receptors, will result in a moderate adverse effect.

Viewpoint 348.3.007: View north from PRoW Whittington Footpath 16 (crossing the playing course of Whittington Heath Golf Club)

9.4.23 Construction activities will be approximately 100m away from this viewpoint representing a PRoW which will be closed by construction for five months. From this viewpoint, there will views along the route of the removal of trees at Whittington Heath Golf Club and of roadside vegetation at Lichfield Road, Whittington in the foreground and background. Construction plant and works for the embankment north to Darnford Lane, including PRoW Whittington Footpath 16 underpass, Lichfield Road underpass and a satellite compound will be prominent in the foreground and middle ground; therefore, the magnitude of change is considered to be high.

9.4.24 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 349.2.002: View east from the A51Tamworth Road near Jockey Rise

9.4.25 Construction activities will be approximately 900m away from this viewpoint. The removal of trees and woods will be visible on the skyline in the middle ground and background. Construction activities for embankments from Lichfield Road, Whittington north and for Darnford Lane overbridge will be visible against the skyline on rising ground, above intervening layers of vegetation. Therefore, the magnitude of change will be high.

9.4.26 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 349.2.004: View north-east from Marsh Farm

9.4.27 Construction activities will lie approximately 400m away from this viewpoint. The removal of boundary vegetation along Darnford Lane will open up views along the route north towards Cappers Lane and south towards Lichfield Road, Whittington. The construction of Darnford Lane overbridge and the embankments north and south will be prominent features in the middle ground, seen across rising land. Therefore, the magnitude of change will be high.

9.4.28 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 349.2.005: View east from Whittington Hill Farm and Whittington Hill House, off Darnford Lane

9.4.29 Construction activities will lie immediately next to this viewpoint. The removal of vegetation in the immediate foreground and the presence of construction plant required for the route in shallow cutting at Darnford Lane, and for embankments north and south will be prominent, however the construction environmental earthworks west of the route and the embankments for Darnford Lane overbridge in the foreground of the view will block views along the route to the north-east and east to the cutting. The magnitude of change will be high.

9.4.30 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.31 Assuming the completion of an additional residential unit at Whittington Hill Farm converted from workshop/ stables as set out in the future baseline section (9.4), the additional receptor will experience the same magnitude of change and extent of effect.

Viewpoint 349.4.008: View north-east from Darnford Lane east of Lichfield

9.4.32 Construction activities will lie approximately 400m away from this viewpoint. The removal of field boundaries and trees and the presence of construction plant required for the embankment north of Darnford Lane to Cappers Lane will be visible in the middle ground. Works for Cappers Lane viaduct and Streethay viaduct will be visible rising above the floodplain in the background, seen above intervening field hedgerows and woods. Therefore, the magnitude of change will be high.

9.4.33 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 349.2.012: View east/south-east from junction of Darnford Lane with Gable Croft

9.4.34 Construction activities will lie over 1.5km from this viewpoint and be constructed on embankment and viaduct across a flood plain in the middle ground. Views of construction operations between Darnford Lane and Cappers Lane will be narrow and channelled by woodlands north of the A38; therefore the magnitude of change to this view will be low.

9.4.35 The low magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 350.2.001: View west from Ellfield House, off Lichfield Road, Whittington

9.4.36 Construction activities will lie approximately 100m west of this viewpoint, and be constructed in the foreground on a combination of embankment and shallow cutting between Lichfield Road, Whittington and Darnford Lane. The removal of field and roadside hedgerows and trees, the demolition of an outbuilding and construction of approach embankments for Darnford Lane overbridge and south towards Lichfield

Road will bring a marked change to the nature of foreground and middle ground of the view, therefore the magnitude of change will be high.

9.4.37 The high magnitude of change when assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 350.2.002: View west from Huddlesford House (and farm), Huddlesford Lane

9.4.38 Construction activities will be seen across low lying land on embankment and viaduct in the background. Part of the view will be screened by a farm building, although taller elements of construction plant at Cappers Lane viaduct and the embankments north and south will be visible above intervening vegetation. The magnitude of change is considered to be medium.

9.4.39 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoints 350.3.005, 350.4.006 and 350.3.007: Views north-west from PRoW Whittington Footpath 8 between Cappers Lane and Darnford Lane, from Darnford Lane near Ellfield Nurseries and from PRoW Whittington Footpath 7, at Cappers Lane

9.4.40 The removal of field boundaries and trees to enable construction will be visible in the foreground and middle ground, north from Darnford Lane overbridge to Huddlesford embankment and Cappers Lane viaduct. Fulfen Wood viaduct and the upper elements of Cappers Lane compound will be visible in the background. The magnitude of change will be high.

9.4.41 The high magnitude of change, assessed alongside the high sensitivity of the receptors, will result in a major adverse effect.

Viewpoint 351.2.001: View east/north-east from Fulfen Farm located between the A38 and Cappers Lane

9.4.42 Construction works for the Proposed Cappers Lane and Fulfen Wood viaducts and linking embankments will be visible in the middle ground. In the foreground, Cappers Lane compound and temporary material stockpile area will be visible, partially screening views to the existing WCML. A section of overhead power line close to the viewpoint will be realigned. The elevated nature of the route and the limited intervening screening will result in a high magnitude of change

9.4.43 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

9.4.44 At night, the lighting at Cappers Lane main compound will be intrusive within the largely unlit context. There will also be partially filtered, background views of lighting at the Cappers Lane viaduct satellite compounds. Therefore, the magnitude of change to this receptor at night will be medium, resulting in a moderate adverse effect.

Viewpoint 351.2.002: View north-east from Fulfen Cottages on Cappers Lane

9.4.45 The construction of an embankment will be visible to the east of this viewpoint. Construction plant and earthworks for the embankment and for Fulfen Wood viaduct to the north and Cappers Lane viaduct to the south will be prominent in the middle ground. A material transfer stockpile and satellite compound off Cappers Lane will be visible in the foreground. The magnitude of change will be high.

9.4.46 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

9.4.47 At night, the lighting at Cappers Lane viaduct and Fulfen Wood viaduct compounds will be intrusive within the largely unlit context. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 351.2.006: View north-east from Ivy Cottage on Broad Lane

9.4.48 Satellite compounds and construction activities for the Fulfen Wood South embankment and viaduct, and for Broad Lane underbridge will occupy the immediate foreground of this view. Extending from the northern side of Broad Lane, up to and beyond the WCML to the Coventry Canal will be temporary materials stockpiles visible in the foreground, middle ground and background. An overhead electricity line will be realigned from the middle ground to the background of the view to accommodate the construction of Fulfen Farm embankment. The proximity and elevated nature of the route will result in a high magnitude of change.

9.4.49 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

9.4.50 At night, the lighting at Fulfen Wood viaduct compounds and at Broad Lane will be intrusive within the foreground views within a largely unlit context. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 351.4.004: View south-east from the A38 near crossing with WCML

9.4.51 Construction activity will occupy the foreground of this elevated view which will overlook the Cappers Lane compound and temporary a material transfer stockpile area. Changes in the middle ground of the view will include the loss of field boundaries, the construction of Fulfen viaduct over the WCML and embankments to the north and south, including Broad Lane underbridge and north and of Cappers Lane viaduct. Construction plant and earthworks operations will be prominent. The magnitude of change will be high.

9.4.52 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

9.4.53 At night, the lighting at Cappers Lane compound and satellite compounds off Cappers Lane will be intrusive within the largely unlit context. There will also be partially filtered, background views of lighting at the main and satellite compounds for the

Cappers Lane viaduct. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 352.2.001: View north-west from Brook House and Mill Farm on Cappers Lane

9.4.54 Satellite compounds will be close to the properties, and earthworks and construction operations for Cappers Lane viaduct and approach embankments will be visible in the middle ground of the view. Views will be partly screened by the construction activities, will extend west along Cappers Lane to a further satellite compound west of the WCML. The magnitude of change will be high. The view of the Proposed Scheme in winter during construction is illustrated on the photomontage shown in Figure LV-01-210 (Volume 2, CFA22Map Book).

9.4.55 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

9.4.56 At night, the lighting at the satellite compounds associated with the Cappers Lane viaducts will be intrusive within the largely unlit context. There will also be partially filtered, background views of lighting at Cappers Lane compound. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 352.2.002: View north-west from Huddlesford junction near canalside property

9.4.57 The construction of the Proposed Scheme will be visible in the middle ground, between and beyond mature trees along the Wyrley and Essington Canal and Broad Lane. The removal of field boundary vegetation, the Fulfen Wood viaduct compound (south) and construction activities for the embankment between Cappers Lane and Fulfen Wood viaduct over the WCML will be visible in the middle ground. The magnitude of change will be high.

9.4.58 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoints 352.2.003 and 352.3.006: View north-west from Broad Lane near Barn Cottage and west from Coventry Canal near Huddlesford Bridge

9.4.59 Visual impacts during construction will include the removal of field boundaries and the use of fields west of the Coventry Canal up to the A38 for construction works in the foreground and middle ground. West of the WCML land occupied by material transfer stockpiles will be visible in the foreground. The construction of embankments between Fulfen Wood viaduct and Streethay viaduct will be visible in the middle ground, with construction activities and plant movements extending to the construction sidings east of the A38 in the background. Therefore, the magnitude of change will be high.

9.4.60 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 353.3.001: View north-east from the PRoW (junction between Footpath Streethay 3 and Streethay 2) near Streethay House Farm

9.4.61 Construction activity associated with Streethay viaduct across the A38 and the embankment to the north will occupy the foreground of this view across gently rising land towards Fradley Industrial Area. Changes to the view will include plant movements on haul routes and the Streethay compound (north-west). The height of the embankment and the change to the extent of view will result in a high magnitude of change.

9.4.62 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 353.3.003: View east from the PRoW Streethay Footpath 1 near to the existing WCML.

9.4.63 The construction of the Proposed Scheme will be approximately 1.2km away, crossing rising land in the middle ground from Streethay viaduct north beyond Wood End Lane realignment towards the Manchester spur. Due to the distance from the viewpoint, and the prominence of Fradley Industrial Area in the existing view, the magnitude of change will be medium.

9.4.64 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 353.2.005: View east from The Manor House adjoining the A38

9.4.65 From this location construction activities for Streethay viaduct and the embankment to the north will dominate the foreground. Adjoining properties will be demolished and temporary earthworks stockpiles, haul routes and a satellite compound will be nearby. Although the A38 on embankment is close to the viewpoint, the proximity of the Proposed Scheme and the absence of screening by vegetation will result in a high magnitude of change.

9.4.66 The high magnitude of change alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.67 At night lighting of the several satellite compounds close to Streethay viaduct will be visible in the foreground, partially obscured by intervening vegetation. Whilst this lighting will be apparent in a previously unlit location, it will be viewed in the context of the extensive area of skyglow in the middle and background of the view. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 353.2.008: View east from residences along Burton Old Road, Streethay

9.4.68 The proximity of adjacent properties on and to either side of Burton Old Road together with the nearby embanked A38 and roadside vegetation will largely screen views to construction operations in the middle ground. Tall construction plant associated with the embankment north of Fulfen Wood viaduct, the Streethay construction sidings, and the material transfer stockpiles west of the WCML will be partially visible. The magnitude of change will be medium.

9.4.69 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 354.2.001: View west from Streethay Farm adjacent to the A38, Streethay

9.4.70 Construction activities for the Streethay viaduct crossing the adjacent A38 will dominate the foreground, although commercial buildings and vegetation close to the viewpoint will partially restrict the availability and extent of views. Nearby satellite compounds will be visible. Taller elements of construction at the eastern extent of Streethay railhead construction sidings and material transfer stockpiles beyond the South Staffordshire Railway Line will be visible in the middle ground. The height and proximity of Streethay viaduct height and the approach embankments will alter existing views, resulting in a high magnitude of change.

9.4.71 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.72 At night, lighting of the several satellite compounds close to Streethay viaduct will be visible in the foreground, partially obscured by intervening vegetation or by other built forms around the farmstead. Whilst this lighting will be apparent in a previously unlit location, it will be viewed in the context of the skyglow in the middle and background of the view. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 354.3.006: View west from King's Orchard Marina, adjacent to Coventry Canal

9.4.73 Construction activities will include the demolition of buildings immediately south of the South Staffordshire railway and the establishment of Streethay viaduct satellite compound in the middle ground. In the foreground, fields west of the Coventry Canal will be used for a temporary material stockpile area. The construction of Streethay viaduct and Fulfen Farm embankment, with Streethay Footpath 6 underpass will be visible in the middle ground, cutting short existing views to the A38 and the outskirts of Lichfield in the background, resulting in a high magnitude of change.

9.4.74 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 354.6.003: View north-west from Streethay Wharf adjacent to the Coventry Canal south of the A38

9.4.75 Construction activities within this view will include the route of the Proposed Scheme in the middle ground crossing the South Staffordshire Line and the A38 dual carriageway at Streethay viaduct, and on embankment to the north. Changes in the view will include the removal of areas of roadside vegetation in the middle ground, increasing the prominence of the viaduct, embankment and taller construction plant. The magnitude of change will be high.

9.4.76 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 355.3.003: View east from the PRoW Streethay Footpath 7, to the east of Curborough House

9.4.77 The Proposed Scheme will lie approximately 500m east of this viewpoint and will be constructed on embankment west of Fradley Industrial Area, across rising land in the middle ground. The removal of field boundaries and haul routes, construction plant and temporary earthworks stockpiles will be visible together with works for a balancing pond and access track. The magnitude of change will be high.

9.4.78 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoints 356.6.001, 356.4.005, 356.3.006, 358.6.004 and 356.6.009: Views west from Nanseawen Road in South Fradley, from junction of Wood End Lane with Nanseawen Road, from PRoW Alrewas 31, at Wood End Lane, from Depot adjoining Wood End Lane and from future receptor at Prologis Park Business Units

9.4.79 Construction activities will lie approximately 200m to 400m west of these viewpoints, and will cross the view on a low embankment, west of Fradley Industrial Area. Construction plant and earthworks will dominate the middle ground, screening background views to Lichfield and the Cathedral spires in a rural setting. The magnitude of change will be high.

9.4.80 The high magnitude of change, assessed alongside the medium sensitivity of the receptors, will result in a moderate adverse effect.

Viewpoint 356.4.004: View south-west from Hilliard's Cross bridge (A38 flyover)

9.4.81 The panorama from this elevated viewpoint will include the removal of vegetation across the middle ground, with the Proposed Scheme constructed on viaduct and embankment. Construction plant for Streethay viaduct crossing the A38 and for the embanked route to the north will be visible, screening lower visibility of the edge of Lichfield, but retaining views of taller features including the Cathedral spires. The extent of the elevated nature of the route within the view will result in a high magnitude of change.

9.4.82 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 356.2.007: View west from Orchard Farm (situated to the north of the A38)

9.4.83 Construction activities will lie approximately 300m west of this viewpoint and will be visible in the foreground on an embankment north of Streethay viaduct. Existing agricultural views beyond the route will be screened by the construction activity, though taller elements on the edge of Lichfield will remain visible in the background. The magnitude of change will be high.

9.4.84 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 356.2.008: View west from Bears Hay Farm, south of the Coventry Canal and close to the A38

9.4.85 Construction activities will lie approximately 1.0km west of this viewpoint. Taller construction elements and plant will be visible in the middle and background, for the construction of Streethay viaduct and adjoining embankments. Some taller elements of the eastern extent of the construction sidings at Streethay and materials transfer stockpiles to the south will be visible, although partly screened by intervening vegetation. The magnitude of change will be medium.

9.4.86 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 357.2.001: View north-east from Highfields Bungalow

9.4.87 The construction of the Proposed Scheme will cross the view on embankment in the middle ground, skirting gently rising land west of Fradley Industrial Area. The lower sections of construction plant and movements will be partially screened by intervening field boundary hedgerows and by woodland at Little Lyntus. However, taller elements of construction operations along the route will be visible, screening views to the lower edge of the Business Park in the background. The magnitude of change will be medium.

9.4.88 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoints 357.2.002, 357.2.003 and 357.3.004: View east from Curborough House, and north-east from Curborough Farm and PRoW Streethay Footpath 4, near Little Curborough

9.4.89 Views from these locations will be characterised by views of construction plant across the middle ground for the embanked route on gently rising land west of Fradley Industrial Area. The lower sections of views will be partially screened by intervening field and lane boundary hedgerows and by woodland at Little Lyntus, although taller construction elements will be partly visible. Due to the distance to the route and the intervening vegetation the magnitude of change will be medium.

9.4.90 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 358.2.003: View west from Gorse Farm, Gorse Lane

9.4.91 Construction activities will be visible in the middle ground on embankment. The lower sections of construction plant and movements will be partially screened by intervening vegetation at Fradley Wood and buildings in Fradley Industrial Area. However, taller elements of the embankment and construction plant will be visible; including those at Curborough Flyover compound will be seen against the skyline. The magnitude of change will be medium.

9.4.92 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 358.4.005 View west from Wood End Lane junction with Gorse Lane

9.4.93 Beyond Wood End Lane the Proposed Scheme will be visible on embankment on and the elevated Curborough flyover, in the foreground at the start of the divergence for the Manchester spur. West of the route, the upper elements of a satellite compound will be visible in the middle ground. Due to the proximity of the construction works, the magnitude of change will be high.

9.4.94 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 359.3.001: View south-west from the PRoW Alrewas Footpath 0.256, near Fradley Wood

9.4.95 From this viewpoint, the Proposed Scheme will be on embankment visible in the middle ground between buildings in Fradley Industrial Area in the foreground. Changes to the view will include the removal of field boundary vegetation along the route crossing gently sloping land. Whilst the lower elements of construction will screened by intervening vegetation, the upper sections of construction elements will be visible against the skyline, including those at Curborough Flyover compound. The magnitude of change will be high.

9.4.96 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 359.3.002: View south-west from the PRoW Alrewas Footpath 44 at its junction with Alrewas Footpath 0.252 and 0.256, near Fradley Junction

9.4.97 Views from this location will be along narrow well-wooded canal corridor to the removal of woodland for the construction of the Proposed Scheme across the Trent and Mersey Canals east viaducts in the middle ground. Although the existing canalside woods will restrict the visibility of the construction of the adjoining embankments north and south of the canal, the magnitude of change will be high.

9.4.98 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoints 360.3.001 and 360.3.007: Views north-east from the Trent and Mersey Canal, close to Wood End Lock Cottage and PRoW Alrewas Footpath 44, on Wood End Lane

9.4.99 Changes within the views will include the removal of canalside hedgerows and trees in the foreground. An access road will be constructed from Wood End Lane to a balancing pond next to the canal. Views from both locations will be dominated by construction activity in the foreground for the Trent and Mersey Canal east viaducts (south and west), the Pyford Brook viaduct (north), their connecting embankments and two satellite compounds. Views north and east to the middle ground will be fore-shortened by the works. The magnitude of change will be high.

9.4.100 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 360.2.002: View north-east from Wood End Farm/The Cottage, Wood End Lane

9.4.101 Construction activities will lie approximately 350m north-east of this viewpoint. The removal of canalside hedgerows and trees and part of Ravenshaw wood will be visible in the middle ground, together with construction operations for the Trent and Mersey Canal west and east viaducts, the Pyford Brook viaduct and their connecting embankments. A satellite compound and balancing pond with access track reached from Wood End Lane will be visible in the foreground although hedgerows on Wood End Lane will provide some limited screening. The magnitude of change will be high.

9.4.102 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 360.4.006: View north and east from Wood End Lane near Ravenshaw Wood

9.4.103 Areas of trees within Ravenshaw Wood canalside vegetation in the middle ground will be removed. An access road from Wood End Lane will lead to a satellite compound in the foreground and a balancing pond next to the canal. The construction for the Trent and Mersey Canal west viaduct, the Pyford Brook viaduct (north), the Trent and Mersey Canal east viaduct and the connecting embankments will be prominent in the middle ground. The magnitude of change will be high.

9.4.104 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 361.2.002: View south-west from Cranberry residence near Fradley Junction

9.4.105 Construction activity for the Trent and Mersey Canal east viaducts, the Pyford Brook viaduct, their connecting embankments and for the embankment at the limit of Phase One railway works of the Manchester spur will be visible in the foreground of this view. Changes to the view will include the removal of part of Brokendown Wood, of vegetation along a section of Pyford Brook and along part of the canal. Haul routes and a satellite compound will be visible. The height of the viaducts and embankments and proximity to the viewpoint will result in a high magnitude of change.

9.4.106 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoints 362.2.001, 362.3.002 and 362.2.003: Views north from Black Slough Farm on Wood End Lane and PRoW Kings Bromley Footpath 0.392, near Tomhay Wood and east from residence (Birch Ridings) on Wood End Lane near Vicar's Coppice

9.4.107 Construction activity will lie approximately 300-400m from these viewpoints located west of the route. Visual changes will include the removal of some areas of hedgerows and trees in the middle ground, and the presence of construction plant for the low embankment north of the Trent and Mersey Canal crossing. Construction works for an access track and balancing pond west of the route will also be visible. However, these views will be partially screened by intervening roadside and field boundaries and trees in Ravenshaw and Black Sough Woods. The magnitude of change will be medium.

9.4.108 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 361.3.003: View south-west from the PRoW Alrewas Footpath 44, adjoining Trent and Mersey Canal

9.4.109 Visual impacts in the foreground will include the removal of trees in part of Brokendown Wood and of vegetation on both sides of the canal for the construction of the Trent and Mersey Canal east viaduct, the embankments to north and south, and a balancing pond and satellite compound with access track. The absence of intervening screening, the proximity and height of the structures will result in a high magnitude of change.

9.4.110 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 363.2.001: View south-east from Wood End Common Barn

9.4.111 Construction activity will lie approximately 500m west of this viewpoint. Areas of trees and canalside vegetation will be removed in the middle ground for the construction of embankments and viaducts at the Trent and Mersey Canal west viaduct and for a satellite compound. A haul route and construction plant will be visible in the foreground and middle ground, along with a balancing pond and Bailey bridge across the canal. A further satellite compound west of the route will be largely screened by intervening woodland. The magnitude of change will be medium.

9.4.112 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 364.2.001: View north-east from Hanch Hall Farm adjoining B5014 Lichfield Road, Handsacre

9.4.113 Construction activity for the WCML Harvey's Rough flyover tie-in will be visible in the foreground, as will works to an overhead power line. Beyond the WCML, views of the middle ground will include the Handsacre (A515) main compound (rail systems) for WCML modification works and taller elements of works at Bourne Brook viaduct, the embankments to north and south, and in the A515 Lichfield Road underbridge main compound east of the route. Although the WCML, its overhead line equipment and train movements are already visible in the foreground, the proximity of the works for the Proposed Scheme and elevation of the route will result in the magnitude of change being medium.

9.4.114 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

9.4.115 At night the lighting of the A515 Lichfield Road underbridge main compound and at the Handsacre (A515) main compound (rail systems) will be visible in the middle ground of the view in a landscape which is, at present, generally unlit. There will also be some oblique views to the Shaw Lane satellite compound (rail systems) seen in the middle ground. Therefore, the magnitude of change to this receptor at night is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 364.2.002: View north and north-east from 'The Elms' on Shaw Lane, close to the junction with the B5014 Lichfield Road, Handsacre

9.4.116 The Shaw Lane satellite compound (rail systems) for WCML modification works will be visible in the foreground, with views of construction activity limited to the upper sections of tall construction plant required at the WCML tie-in. Embankments, retaining walls and flyover at Harvey's Rough will be seen in the middle ground, partially screened by intervening garden and roadside vegetation. The upper sections of Harvey's Rough flyover and the embankment to the south will be visible in the background. Despite the presence of the WCML the magnitude of change will be high.

9.4.117 The high magnitude of change assessed with the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 364.4.008: View north from the bridge on the A515 Lichfield Road

9.4.118 To the far left of the view a satellite compound and haul routes immediately east of the WCML will be visible in the foreground, with the WCML tie-in and the Shaw Lane satellite compound (rail systems) for WCML modification works seen in the middle ground. Intervening hedgerows and small woods north and south of Bourne Brook will screen lower level elements of the construction of Bourne Brook viaduct and the embankment to the north in the middle ground. Views beyond Bourne Brook viaduct to A515 Lichfield Road underbridge main compound in the background will be limited by intervening vegetation. The magnitude of change will be high.

9.4.119 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 365.2.001: View south from Wharf Farm, off the A515 Lichfield Road

9.4.120 Construction activities will lie approximately 600m south of this viewpoint. The construction of the route on embankment between Ravenshaw Wood and the temporary diversion and overbridge for the A515 will be visible in the middle ground. The elevated nature of the route above low level screening vegetation will result in a high magnitude of change.

9.4.121 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 365.3.002: View south-west from Kings Bromley Marina, off A515 Lichfield Road

9.4.122 Views from this location will be characterised by construction plant across a wide arc of the middle ground north and south of the A515. The visibility of construction plant on haul routes across the middle ground will be partially screened by intervening field and roadside hedgerows. A515 Lichfield Road temporary workers' accommodation will be visible in the foreground, with taller elements in A515 Lichfield Road compound and at Bourne Brook viaduct visible in the background. The magnitude of change will be high.

9.4.123 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 365.2.004: View south-west from Tuppenhurst Lane near Shaw Lane Farm and Shaw House

9.4.124 Foreground views will be dominated by a satellite compound, screening lower level views to construction works for the embankment and flyover at Harvey's Rough towards the tie-in with the WCML, though upper elements will remain visible in the middle ground. Although garden hedgerows and outbuildings will provide some screening, the close proximity of construction works will result in a high magnitude of change.

9.4.125 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 365.4.005: View south-west from the A515 Lichfield Road

9.4.126 Construction works in this view will include the Proposed Scheme on embankment and viaduct in the middle ground, crossing the A515. Lichfield Road temporary workers' accommodation and compound will be visible in the foreground north of the A515, screening lower elements of the middle ground views to Bourne Brook viaduct and embankment to the north. The visibility of the route in the foreground and across the middle ground will result in a high magnitude of change.

9.4.127 The high magnitude of change assessed alongside the medium sensitivity of the receptor will result in a major adverse effect.

Viewpoint 366.2.001: View north-east from 'Newtown' located on the B5014 Lichfield Road, Handsacre)

9.4.128 Construction activities will lie approximately 250m north-east of this viewpoint. The upper elements of the construction of the WCML tie-in on flyover at Harvey's Rough viaduct and two Rail Systems satellite compounds for gantry installations as part of the WCML modification works will be visible in the middle ground. Intervening garden vegetation and roadside and field hedgerows will screen views of lower elements of the construction works, therefore the magnitude of change will be medium.

9.4.129 The medium magnitude of change assessed with the high sensitivity of the receptor will result in a moderate adverse effect.

9.4.130 At night, the night working associated with the WCML tie in and for the two Rail Systems satellite compounds will be visible in the middle ground of the view, although partially filtered by existing vegetation along B5014 Lichfield Road, Handsacre. As this will be within a largely unlit area, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoints 366.2.002 and 366.3.008: north-east from Barn Farm (north-east of Longdon Green) and PRoW Longdon 0.394, close to Barn Farm

9.4.131 From these viewpoints, taller elements of the Proposed Scheme for the construction of the tie in to the existing WCML tie-in will be in the middle ground, seen against rising land in the background. As these will form minor components of within a wide panorama, filtered by intervening vegetation, the magnitude of change will be low.

9.4.132 The low magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 366.2.003: View north-east from Hill Top Farm adjacent to the PRoW Longdon 29

9.4.133 Construction activities associated with the WCML tie-in and at Harvey's Rough flyover will be visible in the middle ground approximately 1.0km from this elevated viewpoint. Due to intervening field hedgerows and vegetation these views will be partially screened, resulting in a medium magnitude of change.

9.4.134 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 366.2.007: View north-east from residences adjoining Hanch Hall, B5014 Lichfield Road, Handsacre

9.4.135 Visual changes to the middle ground view will include the upper elements of construction associated with the WCML tie-in, and the embankments and flyover at Harvey's Rough, and the Shaw Lane satellite compound (rail systems) for the WCML modification works. Intervening garden and field boundaries and horticultural polytunnels will screen the visibility of lower construction elements. Due to distance and the intervening vegetation, the magnitude of change will be medium.

9.4.136 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 367.2.001: View south-west from Ashton Hays Farm/Ashton Hays, off Tuppenhurst Lane

9.4.137 Foreground views from this location will be dominated by the immediately adjacent construction activities for Harvey's Rough embankment and flyover and the WCML tie-in. A Rail Systems satellite compounds for gantry installations as part of the WCML modification works will be visible in the foreground east of the WCML/ Proposed Scheme corridor. Land potentially required for construction operations will be visible in the foreground, middle ground and background, extending southwards east of the Proposed Scheme to Shaw Lane. Despite the proximity to the WCML, the close proximity of construction and the elevation of the route will result in a high magnitude of change.

9.4.138 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

9.4.139 At night the night working associated with the WCML tie in will be visible in the foreground within a largely unlit landscape. Therefore, the magnitude of change to this receptor at night is considered to be high, resulting in a major adverse effect.

Viewpoint 367.4.003: View south-west from Tuppenhurst Lane near Shaw House

9.4.140 Construction works for Harvey's Rough flyover, the embankments to north and south, and for the tie-in with the WCML will dominate the foreground of the view. On the left of the view, Harvey's Rough compound on Shaw Lane will be visible. Shaw Lane satellite compounds (rail systems) and for a gantry installation associated with the

WCML modification works will be visible in the middle ground of the view, west of the WCML. Although the construction works for the Proposed Route will ultimately screen some existing foreground views of the WCML, the proximity and elevation of the route will result in a high magnitude of change.

9.4.141 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 367.2.005: View south-west from Shaw Barn, Shaw Lane

9.4.142 The construction for the WCML tie-in and the flyover and embankments at Harvey's Rough will be visible in the middle ground seen against the WCML, overhead line equipment and train movements. The view across arable land will be partially filtered by intervening field boundaries; however the magnitude of change will be high.

9.4.143 The high magnitude of change assessed with the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 368.2.001: View south-east from residential properties located along Chestnut Close, Handsacre

9.4.144 Taller elements of construction plant will be visible to both east and west of the WCML in the foreground and middle ground, for works associated with the WCML tie-in. A materials storage area and access track leading to a balancing pond and a rail systems maintenance access point associated with the WCML modification works will be will be visible in the foreground, west of the WCML. Due to the proximity and elevation of the proposed scheme the magnitude of change will be high

9.4.145 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 369.2.001: View south from residences on Bridge Road, Handsacre

9.4.146 Construction activities associated with the WCML will be visible in the middle ground, with works visible from the tie – in with the existing rail line, extending towards Harvey's Rough viaduct north of Ashton Hayes Farm. Two Rail Systems satellite compounds for WCML modification works will also be visible in the middle ground, north of Ashton Hayes. Taller elements within the Shaw Lane satellite compound (rail systems) and for the northern extent of Harvey's Rough embankment will also be visible in the background of the view, filtered by intervening vegetation. The magnitude of change will be high.

9.4.147 The high magnitude of change assessed with the high sensitivity of the receptor will result in a major adverse effect.

Cumulative effects

9.4.148 Section 2.1 and Volume 5: Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the construction of the Proposed Scheme. The consequential cumulative effect of these developments on LCAs and viewpoints is described below.

The developments are shown on Volume 5: Map Books — Cross topic, Maps CT-13-061 to CT-13-065.

Other mitigation measures

9.4.149 To further reduce the significant effects described above, consideration of where planting can be established early in the construction programme will be given during the detail design stage. This may include consideration of early planting in ecological mitigation sites which would have the additional benefit of providing some visual screening. However, not all landscape and visual effects can be practicably mitigated due to the visibility of construction activity and the sensitivity of surrounding receptors. Therefore, no other mitigation measures are considered practicable during construction.

Summary of likely residual significant effects

9.4.150 These effects will be temporary and reversible in nature lasting only for the duration of the construction works. Any 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.

9.5 Permanent effects arising during operation

9.5.1 The specific elements of the Proposed Scheme that have been taken into account in determining the effects on landscape and visual receptors include:

- permanent cutting and embankment through Whittington Heath Golf Club and across Lichfield Road, Whittington;
- Darnford Lane overbridge;
- Cappers Lane viaducts;
- Broad Lane embankment and underpass;
- Fulfen Wood viaduct over the existing WCML;
- Streethay embankment and viaduct crossing the South Staffordshire Railway Line and A38;
- Manchester spur viaduct and embankments;
- embankments and the Trent and Mersey Canal east and west viaducts and Pyford Brook viaduct between Fradley and Wood End;
- Shaw Lane embankment;
- Bourne Brook viaduct;
- Harvey's Rough flyover and retaining structure;
- Lilac and WCML embankments and tie-in at Handsacre junction; and
- Realignment and reconfiguration of overhead electricity transmission lines, including new electricity pylons.

Avoidance and mitigation measures

9.5.2 The operational assessment of impacts and effects is based on year 1 (2026), year 15 (2041) and year 60 (2086) 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 have been incorporated into the design of the Proposed Scheme include:

- the adoption of a green infrastructure approach to the design of the landscape environment within the Proposed Scheme to ensure the creation of a well-connected landscape that helps to alleviate flooding, and benefit biodiversity and recreation;
- embankment and cuttings, both for the route of the Proposed Scheme and highway realignments, have been shaped so as to integrate the Proposed Scheme into the character of the surrounding landscape;
- where it was considered that a noise fence barrier will create a visual impact on neighbouring residences, where reasonably practicable, a landscape bund has been provided;
- planting, including native broad-leaved woodland, shrubs and hedgerows, to screen the new railway and associated roads from neighbouring residences and users of adjacent PRoW, and to aid integration of the Proposed Scheme into the landscape; and
- selection of species will reflect tree and shrub species native to the area and take into account possible climate change impacts associated with the quality and availability of water and the potential increase in pests and diseases.

9.5.3 Specific design measures to aid in integrating the Proposed Scheme within the landscape include:

- establishment of woodland edge management zones where the Proposed Scheme encroaches upon existing woodland, at Fradley Wood, Ravenshaw Wood and Vicar's Coppice, to enable retention of existing vegetation where possible and a more integrated transition between the Proposed Scheme and retained vegetation;
- ecological mitigation/compensation areas in three main locations — between Mare Brook and Alrewas Footpath 31; within the Wood End Lane realignment; and between the Trent and Mersey Canal to the WCML junction in Handsacre; and
- substantial areas of new planting, between Whittington Heath Golf Club and Broad Lane, at Streethay, near the A38, near the Trent and Mersey west viaduct and north side of Shaw Lane.

9.5.4 These measures have been taken account of in the assessment of the operational effects below.

Assessment of impacts and effects

9.5.5 The likely significant effects on landscape character and viewpoints in operation will arise from new engineered embankments across the existing landscape; the introduction of new viaducts with associated infrastructure; the introduction of noise fence barriers that will create a man-made linear feature; permanent severance of land; the introduction of highway infrastructure into the rural environment, including road bridges; the introduction of overhead line equipment; and the introduction of regular high speed trains. At a number of locations, views of the Proposed Scheme will be almost entirely obscured by existing and retained roadside vegetation. Furthermore, in most cases, effects will reduce over time as planting established as part of the Proposed Scheme matures.

Landscape assessment

9.5.6 This section describes the significant effects on LCAs during year 1, year 15 and year 60 of operation. Non-significant effects on LCSAs are presented in Volume 5: Appendix LV-001-022 Part 4.

9.5.7 The assessment of effects in year 15 assume proposed planting has grown by approximately 450mm a year (i.e. trees will be 7-7.5m high). The assessment of effects in year 60 assumes all planting has reached its fully mature height.

Sandstone Outer Estatelands LCA

9.5.8 The Proposed Scheme will cross the Sandstone Outer Estatelands LCA from the A51/Tamworth Road at Whittington Heath Golf Club to the route of the existing WCML close to Huddlesford. Apart from a short section in shallow cutting at the A51 realignment, the route will be largely on embankment. Landscape effects of the Proposed Scheme will include:

- engineered landforms of steep and graded out embankment slopes cutting across the natural landform, appearing incongruous in the adjacent landscape context;
- introduction of a viaduct spanning Cappers Lane and the disused Wyrley and Essington Canal, and viaduct crossing the WCML as visually prominent man-made structures cutting across a low-lying landscape;
- introduction of overhead line equipment and trains visible on embankment and viaduct, which although both are already present on the WCML, will be at odds with the predominantly rural context; and
- agricultural land either side of the Proposed Scheme will be reinstated and returned to agricultural use but there will be permanent severance of land, requiring access via either overbridges or underpasses.

9.5.9 The presence of high speed trains will result in noise and visual interruption which will reduce tranquillity locally within the predominantly rural area.

9.5.10 The Proposed Scheme will result in the severance of the valued heathland at Whittington. It will also alter the character of the low-lying rural landscape at Cappers Lane, where the Proposed Scheme will be prominent. Therefore, the magnitude of change is considered to be medium in year 1 of operation.

9.5.11 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 1 of operation.

9.5.12 By year 15 of operation, planting will have established sufficiently to begin to deliver greater integration of the Proposed Scheme into the rural landscape, including through:

- reducing the influence of engineered landforms; and
- partially screening overhead line equipment and trains on embankments.

9.5.13 However, due to the continued influence of the viaducts, which will remain prominent landscape features, and the changes to the tranquillity of the area, the magnitude of change will continue to be medium in year 15 of operation.

9.5.14 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 15 of operation.

9.5.15 Therefore the magnitude of change is considered to remain medium, meaning the overall effect will be unchanged in year 15 of operation.

9.5.16 By year 60 of operation, the maturity of planting will further integrate the Proposed Scheme into the landscape; reducing the effects of the viaducts on local landscape character and resulting in effects becoming non-significant. This is reported in Volume 5: Appendix LV-001-022.4.

Settled Farmlands LCA

9.5.17 The Proposed Scheme will pass through the Settled Farmlands LCA from the route of the existing WCML close to Huddlesford to Wood End Lane at Fradley. Landscape effects of the Proposed Scheme will include:

- engineered landforms of steep and graded out embankment slopes crossing the floodplain and valley side slopes, incongruous in the local landscape;
- introduction of overhead line equipment and trains visible on embankments and viaducts. Although both are present on the adjacent WCML, the Proposed Scheme adds additional infrastructure into the local context;
- introduction of a viaduct at Streethay to cross low-lying land, the South Staffordshire Railway Line and the A38, creating an additional highly prominent artificial structure cutting across the landscape; and
- agricultural land either side of the Proposed Scheme will be reinstated and returned to agricultural use, but there will be permanent severance of land, requiring access via either overbridges or underpasses.

9.5.18 The presence of high speed trains will result in noise and visual interruption which will reduce tranquillity locally within the predominantly rural area, despite the existing urbanising influence of traffic on the A38 dual carriageway, the presence of national (South Staffordshire Railway Line) and local rail lines and Fradley Industrial Area.

9.5.19 The Proposed Scheme will result in the loss and fragmentation of woodlands and hedgerows, and will erode into and increase urbanisation of the narrow rural wedge

separating Lichfield and Fradley, affecting local landscape character. Therefore, the magnitude of change is considered to be medium.

9.5.20 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 1 of operation.

9.5.21 By year 15 of operation, planting will have established sufficiently to achieve greater landscape integration of the scheme into the rural landscape, including through:

- reducing the influence of engineered landforms; and
- partially screening overhead line equipment and trains on embankments.

9.5.22 However, due to the continued influence of the Streethay viaduct, which will remain a substantial element in the landscape and the changes to the tranquillity of the area, the magnitude of change will be medium in year 15 of operation.

9.5.23 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 15 of operation.

9.5.24 By year 60 of operation the maturity of planting will further integrate the Proposed Scheme into the landscape, however, the viaduct will continue to have adverse impacts on local landscape character resulting in effects remaining moderate adverse.

Settled Heathlands LCA

9.5.25 The Proposed Scheme will cross the Settled Heathlands LCA from Wood End Lane at Fradley to north of Ashton Hays Farm. Landscape effects of the Proposed Scheme will include:

- engineered landforms of steep and graded out embankment slopes cutting across the natural landform, appearing incongruous in the adjacent landscape context;
- introduction of a flyover at Curborough over the main line of the Proposed Scheme;
- introduction of viaducts crossing the Trent and Mersey Canal and Pyford Brook. These structures will cut across the canalside conservation area, which is a key component of this LCA;
- introduction of overhead line equipment and trains visible on embankment and viaducts, bringing intrusive noise and movement; and
- agricultural land either side of the Proposed Scheme will be reinstated and returned to agricultural use but there will be permanent severance of land, requiring alternative access.

9.5.26 Vegetation lost during construction will change the local landscape context, particularly in the well-wooded canalside. The presence of high speed trains will result in noise and visual interruption which will reduce tranquillity in the middle of the LCA reducing tranquillity within a section of the Trent and Mersey Canal which is both a conservation area and a popular recreational resource. Though these changes will occur over a minor part of the LCA, they will have a significant impact on

characteristic areas of particular value, resulting in a magnitude of change considered to be medium in year 1 of operation.

9.5.27 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year one of operation.

9.5.28 By year 15 of operation, planting will have established sufficiently to achieve greater landscape integration of the scheme into the rural landscape, including through:

- reducing the influence of engineered landforms; and
- partially screening overhead line equipment, noise fence barriers and trains on embankments.

9.5.29 However, the viaducts crossing the Trent and Mersey Canal and Pyford Brook will continue to strongly influence the character of the canalside landscape. As a result of this, and the changes to the tranquillity of the area, the magnitude of change will remain as medium in year 15 of operation.

9.5.30 Therefore the magnitude of change is considered to remain medium, meaning the overall effect will be unchanged for year 15 of operation.

9.5.31 By year 60 of operation, the maturity of planting will further integrate the Proposed Scheme into the landscape resulting in effects becoming non-significant. This is reported in Volume 5: Appendix LV-001-022 Part 4.

Visual assessment

9.5.32 This section describes the significant effects on visual receptors during year 1, year 15 and year 60 of operation. Non-significant effects on visual receptors are presented in Volume 5: Appendix LV-001-022 Part 4.

9.5.33 For each viewpoint the following assessments have been undertaken:

- effects during winter of year 1 of operation;
- effects during summer of year 1 of operation;
- effects during summer of year 15 of operation; and
- effects during summer of year 60 of operation.

9.5.34 Where significant effects have been identified, an assessment of effects at night-time arising from additional lighting has also been undertaken.

9.5.35 The number identifies the viewpoint locations which are shown in Volume 5: Map Book — Landscape and visual assessment, Maps LV-08-092 to LV-08-097. In each case, the middle number (xxx.X.xxx) identifies the type of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 5: Hotels and Healthcare, 6: Employment and 7: Active Sports.

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

Viewpoint 347.2.002: View north-east from South Lodge, on the A51/Tamworth Road

9.5.37 The Proposed Scheme will be visible in the foreground emerging from shallow cutting onto low embankment crossing the golf course. Views across the A51 to the route will be filtered by intervening golf course vegetation. A package substation and access road west of the route will be visible, next to the A51 overbridge. There will be views from the side of the residential property along the rebuilt section of the A51 Tamworth Road over the new overbridge in the foreground and middle ground. Therefore, the magnitude of change is considered to be high.

9.5.38 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect winter of year 1 of operation.

9.5.39 In summer of year 1 of operation, the proposed planting will have yet to mature and effects will remain major adverse.

9.5.40 By year 15 of operation, proposed planting on the rebuilt A51Tamworth Road and to the west of the route will be established, screening lower level views of overhead line equipment and train movements in the foreground. Therefore, the magnitude of change will be medium, giving rise to a moderate adverse effect in the summer of year 15 of operation.

9.5.41 By year 60 of operation, the further growth and maturity of the proposed planting will substantially screen the Proposed Scheme, reducing effects on this viewpoint to non-significant. This is reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 347.4.007: View north-east from Lichfield Road, Whittington

9.5.42 The Proposed Scheme will be visible on embankments and environmental mounding in the middle ground and background between Lichfield Road, Whittington and Cappers Lane viaduct including Darnford Lane overbridge. Though views will be partially obstructed by intervening field boundary vegetation, overhead line equipment and train movements and traffic on Darnford Lane overbridge will be visible. Therefore, the magnitude of change will be medium.

9.5.43 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect winter of year 1 of operation.

9.5.44 In summer of year 1 of operation, whilst the intervening hedgerows will provide some additional screening, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

9.5.45 By year 15 and beyond to year 60 of operation, planting on embankments will be established, screening lower level elements of overhead line equipment and train movements visible in the middle and background, and reducing effects to non-significant. This is reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 348.2.002 and 348.3.003: Views north-west from Thimble Hall Cottage and PRoW Whittington Footpath 17, Sandy Lane

9.5.46 The Proposed Scheme on embankment with environmental mounding, and noise fence barriers north and south of Lichfield Road, Whittington will be visible in the middle ground of this narrow arc of view, between Lichfield Road and the wooded

curtilage of Ellfield House. Although these views will be partially screened by intervening field hedgerows and woodlands, overhead line equipment and passing train will be visible. Therefore, the magnitude of change will be medium.

9.5.47 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.48 In summer of year 1 of operation, whilst the intervening hedgerows will provide some additional screening, the magnitude of change is considered to remain medium, meaning the overall effects will be unchanged.

9.5.49 By year 15 and beyond to year 60 of operation, planting growth on embankments will be maturing, substantially screening the Proposed Scheme, reducing effects to non-significant. This is reported in Volume 5: Appendix LV-001-022 Part 4.

Viewpoint 348.3.007: View north from PRoW Whittington Footpath 16 (crossing the playing course of Whittington Heath Golf Club)

9.5.50 From this viewpoint the Proposed Scheme will emerge from shallow cutting, crossing Whittington Heath Golf Club on low embankment towards Lichfield Road, Whittington. Embankments, noise fence barriers, overhead line equipment and train movements will be visible in the foreground through the intervening golf course woodland. Security fencing will be visible where the footpath is parallel to the route. The magnitude of change will be high.

9.5.51 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.52 In summer of year 1 of operation, whilst the intervening golf course woodland will provide some additional screening, the magnitude of change is considered to remain high, meaning the overall effects will be unchanged.

9.5.53 By year 15 of operation, proposed planting on embankments will be established, screening lower elements of the overhead line equipment and train movements; however taller elements will remain prominent in the foreground. The magnitude of change is considered to be medium, resulting in a moderate adverse effect in the summer of year 15.

9.5.54 By year 60 of operation, the proposed planting will be mature, however, due to the proximity to the Proposed Scheme, taller elements of overhead line equipment and train movements will continue to be visible in the foreground. Therefore the magnitude of change will continue to be medium, resulting in a moderate adverse effect.

Viewpoint 349.2.002: View east from the A51 Tamworth Road, near Jockey Rise

9.5.55 From this viewpoint, Darnford Lane overbridge will be visible in the middle ground with the Proposed Scheme on embankment between Lichfield Road, Whittington and north towards Cappers Lane viaduct. Intervening field hedgerows and trees will provide some screening of the middle ground, though the upper elements of overhead line equipment and train movements will be visible. The magnitude of change is considered to be medium.

9.5.56 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.57 In summer of year 1 of operation, whilst the intervening hedgerows will provide some additional screening, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.58 By year 15 and beyond to year 60 of operation, planting established on embankments as part of the Proposed Scheme will have matured, largely screening train movements. The upper elements of overhead line equipment will be visible in the middle ground, partially screened by intervening vegetation. Therefore, the magnitude of change will be low, reducing effects to non-significant. This is reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 349.2.004: View north-east from Marsh Farm

9.5.59 From this viewpoint, the Proposed Scheme will be visible in the middle ground in shallow cutting beneath Darnford Lane overbridge, then northwards rising on embankment at Cappers Lane viaduct. Intervening vegetation will partially screen views of Darnford Lane overbridge and the overhead line equipment and train movements at grade immediately to the north. Environmental mounding north of Darnford Lane will screen the lower elements of overhead line equipment and trains. The magnitude of change will be medium.

9.5.60 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.61 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.62 By year 15, planting established as part of the Proposed Scheme will be maturing helping to integrate the route into the landscape and screening the lower elements of overhead line equipment and train movements. Therefore, the magnitude of change will be medium, resulting in a moderate adverse effect.

9.5.63 By year 60 of operation, the maturity of the proposed planting will substantially screen the Proposed Scheme, reducing effects to non-significant. This is reported in Volume 5: Appendix LV-001-022 Part 4.

Viewpoint 349.2.005: View east from Whittington Hill Farm and Whittington Hill House off Darnford Lane

9.5.64 The Proposed Scheme will be in close proximity to this viewpoint, with views into the shallow cutting either side of Darnford Lane. However the approach embankments to the lane's overbridge will restrict views to the north. Therefore, the magnitude of change is considered to be high.

9.5.65 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.5.66 In summer of year 1 of operation due to the low growth achieved by the proposed planting, effects will be unchanged.

9.5.67 By year 15 and beyond to year 60 of operation, proposed planting will have established and matured sufficiently to providing screening to the lower elements of both overhead line equipment and train movements. However, due to the close proximity of the route and Darnford Lane overbridge the magnitude of change will remain as high, meaning the overall effect will be unchanged.

Viewpoint 349.4.008: View north-east from Darnford Lane east of Lichfield

9.5.68 The Proposed Scheme will be visible on embankments and viaducts in the middle ground, introducing a new element across the flood plain at Cappers Lane. Due to the loss of middle ground vegetation, the structures, noise fence barriers, overhead line equipment and train movements will be visible, although partially filtered by intervening field boundaries. Therefore, the magnitude of change is considered to be medium.

9.5.69 The medium magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.70 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.71 By year 15 and beyond to year 60 of operation, planting established as part of the Proposed Scheme will have matured, assisting in integrating the route into the landscape setting and providing partial screening of the infrastructure. This will reduce effects to being non-significant. These are reported in Volume 5: Appendix LV-001-022.Part 4.

Viewpoint 350.2.001: View west from Ellfield House, off Lichfield Road, Whittington

9.5.72 From this viewpoint, the Proposed Scheme between Lichfield Road, Whittington and Darnford Lane overbridge will be visible in the foreground, changing from shallow embankment to shallow cutting. Views of the overhead line equipment and train movements will be visible, though partly obscured by environmental embankments east of the route. Darnford Lane overbridge will be prominent. Therefore, the magnitude of change is considered to be high.

9.5.73 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.74 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.75 In year 15 and beyond to year 60 of operation, planting established on the embankments as part of the Proposed Scheme will have matured, screening the embankment and the lower elements of overhead line equipment and passing trains. However the upper elements of overhead line equipment would remain visible in the foreground. Therefore, the magnitude of change will be medium, which alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

Viewpoint 350.2.002: View west from Huddlesford House (and farm), Huddlesford Lane

9.5.76 Cappers Lane viaduct will be visible in the centre of the middle ground of this view. The scale of the structure and its associated embankments and noise fence barriers will be seen above intervening hedgerows and brookside vegetation. The upper elements of overhead line equipment and train movements will be visible. The magnitude of change will be medium.

9.5.77 The medium magnitude of change assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.78 In summer of year 1 of operation, although intervening hedgerow and brook-side vegetation will afford a greater level of screening in the foreground and middle ground, overall effects will be unchanged.

9.5.79 By year 15 of operation, although proposed planting will have established to provide some screening, Cappers Lane viaduct will remain be visible, as will overhead line equipment and train movements. Therefore, effects will be unchanged.

9.5.80 By year 60 of operation, though overhead line equipment and train movements on Cappers lane viaduct will remain visible, the maturity of the proposed planting will substantially screen the approach embankments and overhead line equipment resulting in non-significant effects. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoints 350.3.005, 350.4.006 and 350.3.007: Views north-west from PRoW Whittington Footpath 8 between Cappers Lane and Darnford Lane, from Darnford Lane near Ellfield Nurseries and from PRoW Whittington Footpath 7, at Cappers Lane

9.5.81 From these locations the Proposed Scheme from Darnford Lane, north to Huddlesford embankment, Cappers Lane viaduct and Fulfen Wood embankments and noise fence barriers will be visible in the foreground and middle ground. Darnford Lane over bridge will be prominent in the foreground. Overhead line equipment and train movements will be visible. The magnitude of change will be high.

9.5.82 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.83 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.84 In year 15, maturing mitigation planting on the embankments and overbridge will provide visual screening which will be effective in close proximity, but from higher land overhead line equipment and train movements will be visible. Therefore, the magnitude of change is considered to be medium, which assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

9.5.85 By year 60 of operation, planting will be mature, and although views from higher land will still extend to the upper elements of the overhead line equipment on the approach to and on Cappers Lane viaduct, the magnitude of change will reduce to non-significant effects. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 351.2.001: View east/north-east from Fulfen Farm located between the A38 and Cappers Lane

9.5.86 From this viewpoint, the embankments and noise fence barriers either side of Cappers Lane viaduct and north to Fulfen Wood viaduct and embankments will be visible in the middle ground crossing the broad floodplain, together with overhead line equipment and train movements. The scale and elevation of the Proposed Scheme will cut across existing rural views. Therefore, the magnitude of change will be high.

9.5.87 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.88 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.89 By year 15 of operation, planting growth will provide some screening. Although Cappers Lane viaduct will be visible, views of other viaducts and embankments to the north and of the lower elements of overhead line equipment and train movements will be partly screened. Therefore, the magnitude of change will be medium, giving rise to a moderate adverse effect.

9.5.90 By year 60 of operation, planting will substantially screen embankments, overhead line equipment and train movements. However, views to Cappers Lane viaduct, overhead line equipment and train movements will remain. The magnitude of change will reduce to non-significant effects. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 351.2.002: View north-east from Fulfen Cottages on Cappers Lane

9.5.91 Cappers Lane viaduct, Fulfen Wood embankment and noise fence barriers will be visible in the foreground, extending to include Fulfen Wood viaduct across the WCML. Embankments north of the WCML will be visible in the middle ground. Views across the broad floodplain will be interrupted by the scale and elevation of the Proposed Scheme, except for views beneath Cappers Land viaduct to Huddlesford in the background. Overhead line equipment and gantries and train movements will be visible. Therefore, the magnitude of change will be high.

9.5.92 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.93 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.94 By year 15 and beyond to year 60 of operation, Cappers Lane viaduct and noise fence barriers will remain visible in the foreground, with overhead line equipment and train movements. However, the visibility of other viaducts, embankments, train movements and the lower elements of overhead line equipment will be screened by maturing planting. The magnitude of change will be medium, which assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 351.2.006: View north-east from Ivy Cottage on Broad Lane

9.5.95 Views across the broad floodplain towards the tree-lined Coventry Canal will be interrupted by the embankments of the Proposed Scheme. Broad Lane underbridge, Fulfen Wood south embankment and Fulfen Wood viaduct and noise barrier fences will be visible in the foreground and beyond the WCML, the route will cross the view extending from the middle ground towards Streethay viaduct in the background. The upper elements of overhead line equipment and train movements will be seen above noise barrier fences in the foreground, with overhead line equipment and trains fully visible in the middle ground and background. The proximity and elevated nature of the route and the screening of rural views towards the Coventry Canal will result in a high magnitude of change.

9.5.96 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.97 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.98 By year 15 and beyond to year 60 of operation, Broad Lane underbridge, Fulfen Wood viaduct and noise fence barriers will continue to be prominent in the foreground with the upper elements of overhead line equipment and train movements visible. Although, to the north Fulfen Farm embankments, train movements and the lower elements of overhead line equipment will be screened by maturing planting. Therefore, effects will be unchanged.

Viewpoint 351.4.004: View south-east from the A38 near crossing with WCML

9.5.99 From this elevated viewpoint, there will be views along the WCML in the foreground to Fulfen Wood and Cappers Lane viaducts, their approach embankments and noise fence barriers, crossing a broad arc of the flood plain, in the middle ground. Overhead line equipment and train movements on the Proposed Scheme will be visible, in addition to those on the WCML and an electricity transmission line. The Proposed Scheme will block rural views in the background on rising land beyond. The magnitude of change will be high.

9.5.100 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.101 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.102 By year 15 of operation, planting growth will provide some screening to embankments, though viaducts, overhead line equipment and train movements will remain visible. Therefore the magnitude of change will be medium. Assessed alongside the low sensitivity of the receptor, this will result in a moderate adverse effect.

9.5.103 By year 60 of operation, planting will substantially screen embankments, train movements and the lower elements of overhead line equipment, though views of viaducts, overhead line equipment and trains will remain. This will reduce effects to be non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 352.2.001: View north-west from Brook House and Mill Farm on Cappers Lane

9.5.104 The Proposed Scheme on viaduct, above Cappers Lane, will be visible in the middle ground unobstructed by intervening vegetation. Embankments to the north and south will also be prominent, as will noise fence barriers, overhead line equipment and train movements. The magnitude of change will be high. The view of the Proposed Scheme in the winter of year one of operation is illustrated on the photomontage shown in Figure LV-01-257 (Volume 2, CFA22 Map Book).

9.5.105 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.106 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.107 By year 15 and beyond to year 60 of operation, planting growth will provide some screening to the embankments. However, Cappers Lane viaduct will continue to be prominent in the foreground with overhead line equipment and train movements. Therefore effects will be unchanged. The view of the Proposed Scheme in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-257 (Volume 2, CFA22 Map Book).

Viewpoint 352.2.002: View north-west from Huddlesford junction near canal side residential property

9.5.108 Fulfen Wood viaduct crossing the WCML and the approach embankments to north and south will be visible in the middle ground between and above intervening vegetation. Views will include noise fence barriers, overhead line equipment and train movements. The location and extent of embanked earthworks and a viaduct crossing a broad, level floodplain will result in a high magnitude of change.

9.5.109 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.110 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.111 By year 15 and beyond to year 60 of operation, planting growth will provide some screening to embankments, noise fence barriers and the lower elements of overhead line equipment and train movements on the Proposed Scheme, though views to Fulfen Wood viaduct will remain. The magnitude of change will be medium, which assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoints 352.2.003 and 352.3.006: Views north-west from Broad Lane near Barn Cottage and west from Coventry Canal near Huddlesford Bridge

9.5.112 The Proposed Scheme will be seen in the middle ground, beyond an electricity power line, on embankment crossing a broad floodplain between Fulfen Wood viaduct and Streethay viaduct. The overhead line equipment and train movements will be visible above partial height of the environmental mounding and noise fence barriers. The height of the structures will screen views of the elevated A38 in the background.

Views will be partly screened by canalside vegetation, resulting in a medium magnitude of change

9.5.113 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will have a moderate adverse effect in winter of year 1 of operation.

9.5.114 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.115 By year 15 and beyond to year 60 of operation, planting established on embankments as part of the Proposed Scheme will lessen their engineered appearance and also largely screen noise fence barriers, Overhead line equipment and trains , assisting the route's integration into the local landscape. This will reduce effects to non-significant and these are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 353.3.001: View north-east from the PRoW (junction between Footpath references Streethay 3 and Streethay 2) near Streethay House Farm

9.5.116 The embankments north of Streethay viaduct will be visible in the foreground, crossing gently rising agricultural land. Overhead line equipment and train movements will be visible. The Proposed Scheme will interrupt views to Fradley Industrial Area in the middle ground. Landscape mitigation earthworks will help to assimilate the route into the local landform. Mare Brook culvert and access road will also be visible in the foreground. The magnitude of change is considered to be high.

9.5.117 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.118 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.119 By year 15 of operation, planting growth will partly screen embankments and the lower elements of overhead line equipment and train movements. The magnitude of change is considered to be medium, which will result in a moderate adverse effect.

9.5.120 By year 60 of operation, plant growth will screen views to embankments, train movements and the lower extents of overhead line equipment, resulting in greater integration of the route into the landscape, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 353.2.005: View east from The Manor House adjoining the A38

9.5.121 The Proposed Scheme on viaduct and environmental embankments west of the route will be in the foreground of views from the property. Although there will be some screening by garden vegetation, the viaduct, embankments, overhead line equipment and train movements will be prominent. Due to the elevation, scale and proximity of the Proposed Scheme, the magnitude of change will be high.

9.5.122 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.123 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.124 By year 15 and beyond to year 60 of operation, planting established on the Proposed Scheme embankments and environmental earthworks will provide some screening, assisting the integration of the route into the local landscape. However, due to their proximity, Streethay viaduct and the upper elements of overhead line equipment and train movements will be continue to be visible. Therefore, effects will continue to be unchanged.

Viewpoint 353.2.008: View east from residences along Burton Old Road, Streethay

9.5.125 Embankments between Fulfen Wood viaduct and Streethay viaduct, together with overhead line equipment and train movements will be visible in the middle ground, although the proximity and suburban setting of many of these properties will screen these views. Where the route is visible it will be seen beyond the South Staffordshire Railway Line and traffic movements on the embanked A38. The magnitude of change will be medium.

9.5.126 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.127 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.128 By year 15 and beyond to year 60 of operation, planting established on the Proposed Scheme embankments will have matured, integrating the route into the wider local landscape. Although some upper elements of overhead line equipment and train movements will be visible, effects will reduce to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 354.2.001: View west from Streethay Farm adjacent to the A38, Streethay

9.5.129 Due to proximity, Streethay viaduct will be visible in the foreground despite some screening by adjoining commercial buildings and intervening vegetation. Overhead line equipment and train movements will be prominent. Therefore, despite the presence of the adjoining A38, the magnitude of change is considered to be high.

9.5.130 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.131 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.132 By year 15 and beyond to year 60 of operation, planting growth will be providing some screening to ground level views of the viaduct, despite its proximity. Therefore, although overhead line equipment and train movements will remain visible, the magnitude of change will reduce to medium, resulting in a moderate adverse effect in the summer of years 15 and 60.

Viewpoint 354.3.006: View west from King's Orchard Marina, adjacent to the Coventry Canal

9.5.133 Fulfen Farm embankment and the entrance to Streethay Footpath 6 underpass will be visible in the middle ground, seen over the Coventry Canal and gently sloping arable

land in the foreground. Streethay viaduct spanning the South Staffordshire Line and the embanked A38 will be visible in the middle ground, together with a realigned section of overhead electricity transmission line crossing the route at Fulfen Farm embankment. Overhead line equipment and train movements will be visible. The Proposed Scheme will block views to the southern extents of Lichfield in the background.

9.5.134 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.135 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.136 By year 15 of operation, planting growth will partly screen embankments and the lower elements of overhead line equipment and train movements. The magnitude of change is considered to be medium, which will result in a moderate adverse effect.

9.5.137 By year 60 of operation, plant growth will screen views to embankments, train movements and the lower extents of overhead line equipment, resulting in greater integration of the route into the landscape, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 354.6.003: View north-west from Streethay Wharf on the Coventry Canal south of the A38

9.5.138 The Proposed Scheme will be on viaduct across the South Staffordshire line and the A38 dual carriageway. The viaduct structure, overhead line equipment and train movements will all be visible in the middle ground, seen over and beyond intervening buildings and highways. Therefore the magnitude of change is considered to be high.

9.5.139 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.140 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.141 By year 15 and beyond to year 60 of operation, the growth of planting on mitigation areas to either side of the viaduct will screen some elements of the lower structure, though overhead line equipment and train movements will continue to be visible cutting across the field of view. Therefore, although the magnitude of change will be reduced to medium, a moderate adverse effect will be retained for the summer of years 15 and 60.

Viewpoint 355.3.003: View east from the PRoW Streethay Footpath 7, to the east of Curborough House

9.5.142 The Proposed Scheme on embankment crossing gently rising land will be visible in the middle ground, screening lower level views to Fradley Industrial Area. Overhead line equipment and train movements will be visible. Therefore, the magnitude of change is considered to be high.

9.5.143 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.144 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.145 By year 15 and beyond to year 60 of operation, the growth of planting on embankments and ecological mitigation areas will screen the views of the lower level elements of overhead line equipment and train movements, although the Proposed Scheme will continue to cut across the field of view. Therefore, the magnitude of change will be reduced to medium, giving rise to a moderate adverse effect in the summer of years 15 and 60.

Viewpoints 356.6.001, 356.4.005, 356.3.006, 358.6.004 and 356.6.009: Views west from Nanseawen Road in South Fradley, junction of Wood End Lane with Nanseawen Road, PRoW Alrewas 31, at Wood End Lane, Depot adjoining Wood End Lane and future receptor at Prologis Park Business Units

9.5.146 The Proposed Scheme will be on embankment crossing gently sloping land in the middle ground, and will cut across agricultural views towards Lichfield and the cathedral spires in the background. The extent of the views will be restricted by intervening buildings and structures within Fradley Industrial Area in the foreground and middle ground. Overhead line equipment and train movements will be visible. The magnitude of change will be high.

9.5.147 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.148 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.149 By year 15 and beyond to year 60 of operation, proposed planting on the embankments will be reducing their engineered appearance and screening the lower elements of overhead line equipment and train movements. As a result, although some visibility of overhead line equipment and trains will remain, the magnitude of change will be low reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 356.4.004: View south-west from Hilliard's Cross bridge (A38 flyover)

9.5.150 There will views along the A38 to Streethay viaduct and the embankments to the north in the background, seen against the outskirts of Lichfield. Train movements will be visible across a wide arc of view the middle ground though partially screened by intervening vegetation. The magnitude of change will be medium. The view of the Proposed Scheme in the winter of year one of operation is illustrated on the photomontage shown in Figure LV-01-156 (Volume 2, CFA22 Map Book).

9.5.151 The medium magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation

9.5.152 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.153 By year 15 and beyond to year 60 of operation, planting established on the embankments along the route north and south of the A38 crossing as part of the Proposed Scheme will have matured, and although train movements on Streethay viaduct will continue to be visible, effects will reduce to be non-significant. These are reported in Volume5: Appendix LV-001-022.

Viewpoint 356.2.007: View west from Orchard Farm (situated to the north of the A38)

9.5.154 The Proposed Scheme will be visible on embankment in the foreground. Although views will be partially filtered by existing foreground vegetation, the upper sections of embankment, overhead line equipment and trains will be visible. The magnitude of change will be high.

9.5.155 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.156 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.157 By year 15 and beyond for year 60 of operation, planting established on the embankments as part of the Proposed Scheme will assist the integration of the Proposed Scheme into the local landscape. Therefore, the magnitude of change will be medium, giving rise to a moderate adverse effect in the summer of years 15 and 60.

Viewpoint 357.2.001: View north-east from Highfields Bungalow

9.5.158 The Proposed Scheme will be visible on embankment in the middle ground. The visibility of overhead line equipment and train movements will be partly filtered by intervening garden and field boundary vegetation and by woodland at Little Lyntus. Views of traffic movements on the realigned Wood End Lane will also be filtered by intervening hedgerows. The magnitude of change will be medium.

9.5.159 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.160 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.161 By year 15 and beyond to year 60 of operation, planting established on the embankments and along the realigned Wood End Lane as part of the Proposed Scheme will have matured, reducing the effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 358.4.005: View west from Wood End Lane junction with Gorse Lane

9.5.162 The Proposed Scheme will be visible on embankments of differing heights in the foreground, at the start of the divergence for the Manchester spur. Views will also include the realigned Wood End Lane. Therefore, the magnitude of change is considered to be high.

9.5.163 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.164 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.165 By year 15 and beyond to year 60 of operation, planting proposed as part of the Proposed Scheme will have matured, providing some screening to the embankments and lower elements of overhead line equipment and train movements. However, views of the upper elements and of the realignment of Wood End Lane will remain. Therefore, the magnitude of change will be medium giving rise to a moderate adverse effect in the summer of years 15 and 60 of operation.

Viewpoint 359.3.001: View south-west from the PRoW Alrewas Footpath 0.256, near Fradley Wood

9.5.166 The Proposed Scheme will be visible on embankments of differing heights of at the divergence of the Manchester spur from the route. Visibility will include overhead line equipment and train movements, although the width of the arc of view will be restricted by buildings in Fradley Industrial Area. The magnitude of change will be high.

9.5.167 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in winter of year 1 of operation.

9.5.168 In summer of year 1 of operation, although intervening vegetation will provide increased screening, the magnitude of change is considered to remain high due to the low growth achieved by the proposed planting.

9.5.169 By year 15 and beyond to year 60 of operation, planting established on the Proposed Scheme embankments, road realignment and woodland edges will have matured providing additional screening to views of the route. Therefore, the magnitude of change will be low, resulting in a reduction in effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 359.3.002: View south-west from the PRoW Alrewas Footpath 44 at its junction with Alrewas Footpath 0.252 and 0.256, near Fradley Junction

9.5.170 The Trent and Mersey Canal east viaducts will be visible along a narrow canalside corridor to view in the middle ground. Views will include overhead line equipment and train movements on the bridges. Therefore, the magnitude of change is considered to be high.

9.5.171 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.172 In summer of year 1 of operation, although the growth of the proposed planting will be low, canalside woodland and hedgerows will provide additional screening, reducing the magnitude of change to medium. The medium magnitude of change assessed against the high sensitivity of the receptor will result in a moderate adverse effect.

9.5.173 By year 15 and beyond to year 60 of operation, planting established on the Proposed Scheme embankments and at woodland edges will have matured. Although overhead line equipment and train movements on bridges over the canal will remain visible the effects will reduce to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoints 360.3.001 and 360.3.007: Views north-east from the Trent and Mersey Canal, close to Wood End Lock Cottage and PRoW Alrewas Footpath 44, on Wood End Lane

9.5.174 The Trent and Mersey Canal east and west viaducts and embankments will be visible in the foreground and middle ground.Views to Pyford Brook viaduct in the middle ground will be partially screened by intervening woodland. Overhead line equipment and train movements will be noticeable across a broad elevated arc of view. Also visible north of the Trent and Mersey Canal West viaduct will be a tall, physical structure at the top of the embankment to prevent the movements of bats across the route.Therefore, the magnitude of change will be high.

9.5.175 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.176 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.177 By year 15 of operation, maturing planting will provide some screening of lower elements of the Proposed Scheme, although the upper elements of train movements, overhead line equipment and, north of the Trent and Mersey Canal West viaduct, ofa tall physical structure at the top of the embankment to prevent the movements of bats across the route will remain visible. Due to the continued visible extent and proximity of the Proposed Scheme the magnitude of change will remain high, resulting in a major adverse effect.

9.5.178 By year 60, the further growth and maturity of the proposed planting will succeed in reinstating the wooded canalside corridor. However, viaduct supporting structures and overhead line equipment and train movements on viaductswill be continue to be visible, as will the upper elements of overhead line equipment on linking embankments. Therefore, the magnitude of change will be medium, resulting in a moderate adverse effect.

Viewpoint 360.2.002: View north-east from Wood End Farm/The Cottage, Wood End Lane

9.5.179 The Proposed Scheme will be visible on viaducts and embankments beyond and across the Trent and Mersey Canal in a broad arc of view in the middle ground, with train movements and overhead line equipment visible. North of the Trent and Mersey Canal West viaduct, a tall, physical structure to prevent the movements of bats across the route will also be visible.The wide gaps in the mature canalside woodlands will be noticeable. Due to the elevation and scale of the Proposed Scheme, the magnitude of change will be high.

9.5.180 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in winter of year 1 of operation.

9.5.181 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.182 By year 15 and beyond to year 60 of operation, planting growth will mature to screen lower elements of the Proposed Scheme, although the scale of changes to the canalside corridor will remain visible including the upper elements of overhead line

equipment and train movements on embankments and across the viaducts. However, the magnitude of change will reduce to medium, resulting in a moderate adverse effect in the summer of years 15 and 60.

Viewpoint 360.4.006: View north and north-east from Wood End Lane near Ravenshaw Wood

9.5.183 The Proposed Scheme will be seen above intervening roadside hedgerows crossing the Trent and Mersey Canal and Pyford Brook on viaducts and embankments in the middle ground, with overhead line equipment and train movements visible.Also visible, north of the Trent and Mersey Canal West viaduct, positioned at the top of the embankment will be a tall, physical structure to prevent the movement of bats across the route. As the route passes east of Ravenshaw Wood the lower elements of these structures and train movements will be screened from view. The magnitude of change is considered to be high in the winter of year 1 of operation.

9.5.184 The high magnitude of change, assessed alongside the medium sensitivity of the receptor will result in a moderate adverse effect.

9.5.185 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.186 By year 15 and beyond to year 60 of operation, the proposed planting will have matured, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 361.2.002: View south-west from Cranberry residence near Fradley Junction

9.5.187 The Pyford Brook viaduct will be visible in the centre of this view in the middle ground, with the embankment to the south also prominent. Vegetation along Pyford Brook and environmental mounding east of the route will screen lower elements of the Proposed Scheme north of the Brook, though taller elements of overhead line equipment and train movements will be visible. North of the Trent and Mersey Canal West viaduct, a tall physical barrier located at the top of the embankment to prevent the movement of bats across the across the route will also be visible. To the left of this view, the upper elements of the terminal embankment for the Manchester spur will be visible in the foreground. The scale of the viaducts and embankments and proximity of the route to the viewpoint will result in a high magnitude of change.

9.5.188 The high magnitude of change assessed alongside the high sensitivity of the receptors will result in a major adverse effect in winter of year 1 of operation.

9.5.189 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.190 By year 15 and beyond to year 60 of operation, proposed planting will have matured to screen lower elements of the Proposed Scheme, although overhead line equipment and train movements on the viaducts will remain visible. However, the magnitude of change will reduce to medium, resulting in a moderate adverse effect in the summer of years 15 and 60.

Viewpoints 362.2.001, 362.3.002 and 362.2.003: Views north from Black Slough Farm on Wood End Lane, and PRoW Kings Bromley Footpath 0.392, near Tomhay Wood and east from residential property (Birch Ridings) on Wood End Lane near Vicar's Coppice

9.5.191 From these viewpoints the Proposed Scheme will be visible on embankment in the middle ground from north of the Trent and Mersey Canal to Bourne Brook viaduct. Train movements, overhead line equipment and a tall, physical structure located at the top of the embankment to prevent the movement of bats across the route will be visible. The A515 Lichfield Road underbridge will also be visible, though the range of views will be dependent on the particular location and aspect, and on the extent of intervening woodland and field boundaries. The magnitude of change will be high.

9.5.192 The medium magnitude of change assessed, alongside the high sensitivity of the receptors will result in a major adverse effect in winter of year 1 of operation.

9.5.193 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.194 By year 15 and beyond to year 60 of operation, planting growth will be maturing to provide screening of the Proposed Scheme from ground level views, although the upper elements of overhead line equipment, the physical structure to prevent bat movement across the route and trains will be visible. However, the magnitude of change will reduce to low, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 361.3.003: View south-west from the PRoW Alrewas Footpath 44, adjoining Trent and Mersey Canal

9.5.195 The Trent and Mersey Canal east viaduct and adjoining embankments will be visible in the foreground and middle ground, with a view through the supporting structure and along the canal corridor toward a bend in the background. Overhead line equipment and train movements will be visible on the viaduct. The proximity, scale and elevation of these structures will be visually intrusive in the context of the canal corridor. Therefore, the magnitude of change will be high. The view of the Proposed Scheme in the winter of year one of operation is illustrated on the photomontage shown in Figure LV-01-158 (Volume 2, CFA22 Map Book).

9.5.196 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.197 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.198 By year 15 and beyond to year 60 of operation, although the proposed planting will be have matured the elements of the Proposed Scheme crossing the canal, including overhead line equipment and train movements will remain prominent. Therefore, effects will remain unchanged.

Viewpoint 363.2.001: View south-east from Wood End Common Barn

9.5.199 The Trent and Mersey Canal West viaduct and approach embankments to the north and south will be visible in the middle ground, together with overhead line equipment

and and a tall, physical structure preventing the movement of bats across the route, located north of the Trent and Mersey Canal West viaduct. Intervening canalside hedgerow and trees east of the Trent and Mersey Canal will provide some partial screening of lower elements of the Proposed Scheme, resulting in a medium magnitude of change.

9.5.200 The medium magnitude of change assessed alongside the high sensitivity of the receptors will result in a moderate adverse effect in winter of year 1 of operation.

9.5.201 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.202 By year 15 and beyond to year 60 of operation, planting established on the Proposed Scheme embankments and to woodland edges will have matured, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 364.2.001: View north-east from Hanch Hall Farm adjoining B5014 Lichfield Road, Handsacre

9.5.203 The Proposed Scheme will be visible beyond the WCML in the foreground. Harvey's Rough embankment, overhead line equipment and train movements will be seen above intervening vegetation on the approach to the WCML tie-in, though Bourne Brook viaduct in the middle ground will be partly screened by intervening woodland. As the WCML is an existing prominent component of views in the foreground, the scale and elevation of the embankments and additional overhead line equipment and train movements in the middle ground will result in a medium magnitude of change.

9.5.204 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.205 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.206 By year 15 and beyond to year 60 of operation, planting established on the Proposed Scheme embankments and to severed agricultural land will have matured, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 364.2.002: View north-east from 'The Elms' on Shaw Lane, close to the junction with the B5014 Lichfield Road, Handsacre

9.5.207 The Proposed Scheme will be visible beyond the WCML, with Harvey's Rough embankment and flyover on the approach to the WCML tie-in seen in the middle ground. The visibility of the Proposed Scheme will be partially filtered by intervening garden and field boundaries and woodland. The magnitude of change will be medium.

9.5.208 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.209 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.210 By year 15 and beyond to year 60 of operation, planting established on the Proposed Scheme embankments, on severed agricultural land and to a road closure will have

matured, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 364.4.008: View north from the WCML bridge on the A515 Lichfield Road

9.5.211 The route will be visible on overbridge crossing the A515 Lichfield Road and further north on embankment approaching Bourne Brook viaduct. There will also be views to the Proposed Scheme along and across the WCML. Overhead line equipment and train movements will be visible in the background, from the A515, towards Bourne Brook viaduct and beyond to Harvey's Rough flyover, although intervening woodland at Bourne Brook will largely screen the viaduct. Due to the extent and elevation of the Proposed Scheme the magnitude of change will be high. The view of the Proposed Scheme in the winter of year one of operation is illustrated on the photomontage shown in Figure LV-01-160 (Volume 2, CFA22 Map Book).

9.5.212 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.213 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting

9.5.214 By year 15 of operation, although proposed planting on embankments and mitigation areas will have matured, the overhead line equipment and train movements will remain visible. The magnitude of change will be medium, resulting in a reduction to a moderate adverse effect. The view of the Proposed Scheme in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-261 (Volume 2, CFA22 Map Book).

9.5.215 By year 60 of operation, the further growth and maturity of the proposed planting will provide substantial screening, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 365.2.001: View south from Wharf Farm, off the A515 Lichfield Road

9.5.216 There will be views across rising land to the Proposed Scheme on embankment south of Bourne Brook viaduct, north to Harvey's Rough retaining structure and flyover in the middle ground. The visibility of the WCML will be obscured by the embanked route. The magnitude of change will be high.

9.5.217 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in winter of year 1 of operation.

9.5.218 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.219 By year 15 of operation, maturing planting north of Bourne Brook will screen lower level elements of the Proposed Scheme and partially screen views to the WCML. Therefore, the magnitude of change will be medium, resulting in a moderate adverse effect.

9.5.220 By year 60, the further growth and maturity of the proposed planting will provide substantial screening, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 365.3.002: View south-west from Kings Bromley Marina , off A515 Lichfield Road

9.5.221 The Proposed Scheme will be visible across rising land on embankment from south of the A515 northwards to Harvey's Rough retaining structure and flyover, with the WCML visible beyond the route. The extent of the embankments and viaduct crossing the arc of view in the middle ground will result in a medium magnitude of change.

9.5.222 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.223 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.224 By year 15 and beyond to year 60 of operation, the maturity of the proposed planting will provide substantial screening, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 365.2.004: View south-west from Tuppenhurst Lane near Shaw Lane Farm and Shaw House

9.5.225 The Proposed Scheme will be visible on Shaw Lane embankment and viaduct in the middle ground, at Harvey's Rough flyover on the approach to the tie-in with the WCML. Overhead line equipment and train movements will be visible, with the Proposed Scheme blocking rural views beyond. Due to the proximity and elevation of the route the magnitude of change will be high. The view of the Proposed Scheme in the winter of year one of operation is illustrated on the photomontage shown in Figure LV-01-161 (Volume 2, CFA22 Map Book).

9.5.226 In winter of year 1 of operation, the high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.5.227 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.228 By year 15 and beyond to year 60 of operation, proposed planting on embankments and mitigation areas will have matured partially screening the lower levels of overhead line equipment and train movements. However, due to the proximity and elevation of the route, the Proposed Scheme will remain visible. Therefore effects will be unchanged. The view of the Proposed Scheme in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-262 (Volume 2, CFA22 Map Book).

Viewpoint 365.4.005: View south-west from the A515 Lichfield Road

9.5.229 The Proposed Scheme will be visible in the middle ground on embankment crossing the A515 Lichfield Road on overbridge and northwards to Bourne Brook viaduct, and the embankments at Harvey's Rough. The A515 Lichfield Road underbridge will be in the centre of the view, with overhead line equipment and train movements visible along the elevated route. The magnitude of change will be high.

9.5.230 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.231 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.232 By year 15 of operation, planting growth will be providing some visual screening, although Bourne Brook viaduct and the upper elements of overhead line equipment and train movements will remain visible. The magnitude of change will reduce to medium, resulting in a moderate adverse effect.

9.5.233 By year 60 of operation, the further growth and maturity of the proposed planting will provide substantial screening, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 366.2.001: View north-east from 'Newtown' located on the B5014 Lichfield Road Handsacre

9.5.234 There will be views to Harvey's Rough flyover at the tie-in of the Proposed Scheme with the WCML, including a pedestrian underpass in the foreground, though these will be partly screened by intervening vegetation. Views of overhead line equipment and train movements will be additional to those on the WCML. The magnitude of change will be medium.

9.5.235 The medium magnitude of change assessed with the high sensitivity of the receptor will result in a moderate adverse effect in winter of year 1 of operation.

9.5.236 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.237 By year 15 and beyond to year 60 of operation, maturing planting will contribute to the screening of lower elements of the Proposed Scheme, but there will be visibility of the overhead line equipment and train movements in addition to those on the WCML. The level of change will remain as medium, resulting in a moderate adverse effect.

Viewpoint 366.2.007: View north-east from residential properties adjoining Hanch Hall, B5014 Lichfield Road, Handsacre

9.5.238 There will be views beyond the WCML to the Proposed Scheme from Harvey's Rough flyover to the WCML in the middle ground. However, the availability and extent of these views will depend on aspect and intervening vegetation. The magnitude of change will be medium.

9.5.239 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect in winter of year 1 of operation.

9.5.240 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.241 By year 15 and beyond to year 60 of operation, the growth and maturity of the proposed planting will provide substantial screening, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 367.2.001: View south-west from Ashton Hays Farm/Ashton Hays, off Tuppenhurst Lane

9.5.242 The embanked Proposed Scheme at the WCML tie-in north of Harvey's Rough, together with environmental mitigation earthworks will be visible in the immediate foreground. Kings Bromley pedestrian underpass will be adjacent to the viewpoint and overhead line equipment and train movements will add to those on the nearby WCML. The magnitude of change will be high.

9.5.243 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.244 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.245 By year 15 of operation, proposed planting either side of the underpass, east of Harvey's Rough flyover will screen some ground level views to lower level elements of overhead line equipment and train movements. However, to either side of the entrance to the footpath underpass, overhead line equipment and train movements will continue to be fully visible. The magnitude of change will be high, continuing to result in a major adverse effect.

9.5.246 By year 60 of operation, the further growth and maturity of the proposed planting will provide screening (with the exception of the immediate vicinity of the entrance to the footpath underpass), to the lower elements of Harvey's Rough flyover, though the upper elements of overhead line equipment and train movements will remain visible, reducing the magnitude of change to medium, and resulting in moderate adverse effects.

Viewpoint 367.4.003: View south-west from Tuppenhurst Lane near Shaw House

9.5.247 There will be a view to the Proposed Scheme in the foreground, on embankment and north to the flyover and retaining structures at Harvey's Rough, on the approach to the tie-in with the WCML. Overhead line equipment and train movements will be visible in addition to those on the nearby WCML. The magnitude of change will be high.

9.5.248 The high magnitude of change, assessed alongside the medium sensitivity of the receptor, will result in a major adverse effect in winter of year 1 of operation.

9.5.249 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.250 By year 15 and beyond for year 60 of operation, the growth of maturing mitigation planting will screen views to lower elements of the Proposed Scheme, but overhead line equipment and train movements will be visible in addition to those on the WCML. The level of change will reduce to medium, resulting in a moderate adverse effect.

Viewpoint 367.2.005: View south-west from Shaw Barn, Shaw Lane

9.5.251 There will be longer distance views to Harvey's Rough flyover, retaining structures and tie-in with the WCML, which will be visible beyond the Proposed Scheme. The magnitude of change will be medium.

9.5.252 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in winter of year 1 of operation.

9.5.253 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.254 By year 15 and beyond to year 60 of operation, the growth and maturity of the proposed planting will provide substantial screening, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Viewpoint 368.2.001: View south-east from residences located along Chestnut Close, Handsacre

9.5.255 The Proposed Scheme will be visible in the foreground and middle ground, beyond the WCML on Harvey's Rough flyover and embankment, reducing in height on the approach to the WCML tie-in. Overhead line equipment and train movements would be visible, in addition to those already visible on the WCML. Therefore the magnitude of change will be high.

9.5.256 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in winter of year 1 of operation.

9.5.257 In summer of year 1 of operation, effects will be unchanged due to the low growth achieved by the proposed planting.

9.5.258 By year 15 of operation, planting growth will be providing some visual screening, although the upper elements of overhead line equipment and train movements on Harvey's Rough flyover in the middle ground will remain visible. The magnitude of change will reduce to medium, resulting in a moderate adverse effect

9.5.259 By year 60 of operation, the growth and maturity of the proposed planting will provide screening of lower elements of overhead line equipment and train movements, reducing effects to non-significant. These are reported in Volume 5: Appendix LV-001-022.4.

Cumulative effects

9.5.260 Section 2.1 and Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme. The consequential cumulative effect of these committed developments on LCA and viewpoints is described below. The developments are shown in Volume 5: Map Book – Cross-Topic Maps, Maps CT-13-061 to CT-13-065.

9.5.261 There are no known developments which are assumed to be under construction at the same time as the Proposed Scheme, and therefore there are no consequential cumulative effects on the LCA and viewpoints.

Other mitigation measures

9.5.262 The permanent effects of the Proposed Scheme on landscape and visual receptors have been substantially reduced through incorporation of the measures described previously. Effects in year 1 of operation may be further reduced by establishing

planting early in the construction programme, which will be considered during the detail design stage. This would provide additional screening and greater integration of the Proposed Scheme into the landscape. However, no other mitigation measures are considered practicable due to the high visibility of elements of the Proposed Scheme and the sensitivity of the surrounding receptors.

Summary of likely residual significant effects

9.5.263 In most cases, significant effects will reduce over time, as the proposed mitigation planting matures and reaches its designed intention. Therefore, on the basis that the proposed other mitigation measures are delivered, the following residual effects will remain following year 15 of operation:

- adverse effects on the character of the Sandstone Outer Estatelands LCA, due to the influence of engineered landforms and viaducts on a rural landscape. These effects will reduce by year 60 of operation, following greater maturity of the proposed planting;
- adverse effects on the character of the Settled Farmlands LCA, due to the influence of engineered landforms and viaducts on a rural landscape. Although the proposed planting will be mature by operation year 60, the magnitude of effects will remain as moderate adverse;
- adverse effects on the character of the Settled Heathlands LCA, due to the influence of engineered landforms and viaducts on a rural landscape. Although the proposed planting will be mature by operation year 60, the magnitude of effects will remain as moderate adverse;
- adverse effects on views from a residential property on the A51 Tamworth Road at Whittington Heath (347.2.002) arising from the visibility of the Proposed Scheme on low embankment crossing the golf course and of the replaced A51 Tamworth Road overbridge. These will reduce by year 60 of operation following greater maturity of the proposed planting;
- adverse effects on views from residential properties on Darnford Lane, west of the Proposed Scheme at Whittington Hill Farm and House (349.2.005), and east of the route at Ellfield House (350.2.001) arising from the visibility of the Proposed Scheme on Whittington Common embankment and of Darnford Lane overbridge. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects will remain after operational year 60;
- adverse effects on views from Huddlesford House and Farm residential properties (350.2.002) on Huddlesford Lane arising from the visibility of the Proposed Scheme on embankment to the north and south, and on viaduct crossing Cappers Lane. These will reduce by year 60 of operation following greater maturity of the proposed planting;
- adverse effects on views from residential properties on Cappers Lane at Fulfen Farm and Fulfen Cottages (351.2.001 and 351.2.002) arising from the visibility of the Proposed Scheme on viaduct at Cappers Lane and on embankment at Fulfen Wood (south). Although some of these effects will reduce by year 60 of

operation following greater maturity of the proposed planting, effects on Fulfen Farm will remain after operational year 60;

- adverse effects on views from residential property Ivy Cottage on Broad Lane (351.2.006) arising from the proximity and visibility of the Proposed Scheme on embankment and overbridge at Broad Lane and on viaduct and embankment over the WCML at Fulfen Wood. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects on Ivy Cottage will remain after operational year 60;
- adverse effects on views from Brook House and Mill Farm on Cappers Lane (352.2.001) arising from the visibility of the Proposed Scheme on viaduct and embankment. Due to proximity and elevation the effects on these properties will remain beyond operational year 60;
- adverse effects on views from the canalside residential property at Huddlesford junction (352.2.002) arising from the visibility of the Proposed Scheme on viaduct and embankment at Fulfen Wood. These will reduce by year 60 of operation following greater maturity of the proposed planting
- adverse effects on views from residential properties Manor House, Streethay Farm and Orchard Farm (353.2.005, 354.2.001 and 356.2.007) accessed from the A38 at Streethay, arising from the visibility of the Proposed Scheme on embankment and viaduct at Streethay. Although the proposed planting will continue to mature up to and beyond operational year 60, effects on three residences will remain;
- adverse effects on views from Wood End Farm and Cottage (360.2.002) on/ reached from Wood End Lane, arising from the visibility of the Proposed Scheme on embankment and viaduct across the Trent and Mersey Canal. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects on one residence will remain after operational year 60;
- adverse effects on views from residential property Cranberry (361.1.002), near Fradley Junction, arising from the visibility of the Proposed Scheme on embankment and viaduct crossing the Pyford Brook and the Manchester spur embankment, north of the Trent and Mersey Canal;
- adverse effects on views from residential properties on Shaw Lane on embankment and flyover at Harvey's Rough and the tie-in with the WCML. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects on one residence will remain after operational year 60;
- adverse effects on views from residential property on the A515 Lichfield Road at Wharf Farm (365.2.001) arising from the visibility of the Proposed Scheme embankment and flyover at Harvey's Rough and the tie-in with the WCML. These will reduce by year 60 of operation following greater maturity of the proposed planting;
- adverse effects on views from residential properties Shaw Lane Farm and

Shaw House on Tuppenhurst Lane (365.2.004) arising from the visibility of the Proposed Scheme on embankment and flyover at Harvey's Rough and the tie-in with the WCML Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects will remain significant after operational year 60;

- adverse effects on views from residential properties at Newtown on B5014 Lichfield Road, Handsacre (366.2.001) arising from the visibility of the Proposed Scheme embankment and flyover at Harvey's Rough and the tie-in with the WCML. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects will remain significant after operational year 60;

- adverse effects on views from residential property at Ashton Hayes Farm (367.2.001), off Tuppenhurst Lane arising from the proximity and visibility of an elevated section of route at Harvey's Rough flyover and a pedestrian underpass. Although some of these effects will reduce by year 60 of operation following greater maturity of the proposed planting, effects will remain after operational year 60;

- adverse effects on users of PRoW and other recreational resources across parts of the study area arising from the visibility of the different elements of the Proposed Scheme including trains, noise fence barriers and overhead line equipment, although some of these effects will reduce by year 60 of operation, effects on users of the following PRoW will remain at:

  - crossing Whittington Heath Golf Club (PRoW Whittington Footpath 16) (348.3.007), arising from the proximity and visibility of the Proposed Scheme in shallow cutting and on low embankment across the golf course, including overhead line equipment and train movements. Although proposed planting will mature over time, these effects will remain at operational year 60 and beyond;

  - from PRoW Footpath 8 between Cappers Lane and Darnford Lane (350.3.005) and north west from PRoW Whittington Footpath 7, at Cappers Lane (350.3.007);, arising from the visibility of the Proposed Scheme on Huddlesford embankment and at Cappers Lane viaduct. Overhead line equipment and train movements will be visible. Following greater maturity of the proposed planting, these effects will reduce to be non-significant by operational year 60;

  - from junction between PRoW's Streethay 3 and 2, near Streethay House Farm (353.3.001), arising from the proximity and visibility of the Proposed Scheme on embankment north of Streethay viaduct. Overhead line equipment and train movements will be visible. Following greater maturity of the proposed planting, these effects will reduce to be non-significant by operational year 60;

  - from King's Orchard Marina, east of the Coventry Canal towpath (354.3.006), arising from the visibility of the Proposed Scheme on Fulfen Farm embankment and on Streethay viaduct. Overhead line equipment and train movements will be visible. Following greater maturity of the proposed planting, these effects will reduce to be non-significant by operational year 60;

- from PRoW Streethay Footpath 7 east of Curborough House (355.3.003) arising from the visibility of the Proposed Scheme on embankment, including overhead line equipment and train movements. Although proposed planting will mature over time, these effects will remain at operational year 60 and beyond;

- from adjacent to the Trent and Mersey Canal and on PRoW Alrewas Footpath 44) on Wood End Lane (360.3.001 and 360.3.007), arising from the proximity and visibility of the Proposed Scheme on embankment and viaducts crossing the Trent and Mersey Canal and Pyford Brook. Although the proposed planting will mature over time, these effects will remain at operational year 60 and beyond; and

- from along the Trent and Mersey Canal at Fradley, PRoW Alrewas Footpath 44 (361.3.003); arising from the proximity and elevation of the Proposed Scheme on viaduct across the Trent and Mersey Canal and towpath. Overhead line equipment and train movements will be visible and although the proposed planting will mature over time, these effects will remain at operational year 60 and beyond.

- adverse effects on users of transport routes across parts of the study area arising from the visibility of the different elements of the Proposed Scheme including trains, noise fence barriers and overhead line equipment at:

  - from Darnford Lane, near to Ellfield Nurseries (350.4.006), arising from the proximity and visibility of Darnford Lane overbridge and embankments and the upper elements of the Proposed Scheme. Following greater maturity of the proposed planting, these effects will reduce to be non-significant by operational year 60;

  - from the A38 west of the crossing of the WCML (351.4.004), arising from the visibility of Fulfen Wood viaduct and embankments and the upper elements of the Proposed Scheme and of train movements on the viaduct. Following greater maturity of the proposed planting, these effects will reduce to be non-significant by operational year 60;

  - from the A38 flyover at Hilliard's Cross bridge (356.4.004), arising from the visibility of Streethay viaduct, overhead line equipment and train movements. Due to the location of the viaduct across the A38 dual carriageway, the maturing of the proposed planting will not be able to reduce these impacts over time;

  - from the junction between Wood End Lane and Gorse Lane (358.4.005), arising from the proximity and visibility of the Proposed Scheme and the Manchester Spur on embankments and the realignment of Wood End Lane. These effects will remain at operational year 60 and beyond;

  - from the A515 Lichfield Road bridge crossing the WCML (364.4.008), arising from the proximity and visibility of the Proposed Scheme both along the WCML and at Bourne Brook viaduct. Following greater maturity of the proposed planting, these effects will reduce to be non-significant by operational year 60;

  - from the A515 Lichfield Road, east of the Proposed Scheme (365.4.005) arising from the proximity and visibility of the Proposed Scheme crossing the A515 Lichfield Road underbridge. Following greater maturity of the proposed planting, these

effects will reduce to be non-significant by operational year 60; and

- from Tuppenhurst Lane, near Shaw House (367.4.003) arising from the proximity and visibility of the Proposed Scheme on embankment and flyover at Harvey's Rough. These effects will remain at operational year 60 and beyond.

- adverse effects on workers in employment locations at:

  - Streethay Wharf on the Coventry Canal, adjacent to the A38 (354.6.003), arising from the visibility of the Proposed Scheme at Streethay Viaduct across the A38 corridor, including the viaduct structure, overhead line equipment and train movements. Due to the location of the viaduct across a dual carriageway, the maturing of the proposed planting will not be able to reduce these impacts over time.

10 Socio-economics

10.1 Introduction

10.1.1 The section reports the likely significant economic and employment effects during the construction and operation of the Proposed Scheme.

10.1.2 The need for a socio-economic assessment results from the potential for the Proposed Scheme to affect:

- existing businesses and community organisations and thus the amount of local employment;
- local economies, including employment; and
- planned growth and development.

10.1.3 The beneficial and adverse socio-economic effects of the Proposed Scheme are reported at two different levels: route-wide; and CFA. Effects on levels of employment are reported at a route-wide level in Volume 3. Localised effects on businesses and observations on potential local economic effects are reported within each CFA report.

Construction

10.1.4 The proposed construction works will have the following relevance in terms of socio-economics in relation to:

- premises demolished with their occupants and employees needing to relocate to allow for construction of the Proposed Scheme; and
- potential employment opportunities arising from construction in the local area (including in adjacent CFA).

Operation

10.1.5 The proposed operation of the route will have relevance in terms of socio-economics, in relation to the potential employment opportunities created by new business opportunities.

10.2 Scope, assumptions and limitations

10.2.1 The assessment scope, key assumptions and limitations for the socio-economics assessment are set out in Section 8.10 of Volume 1, the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

10.2.2 There have been no variations to the socio-economic assessment methodology arising from engagement with stakeholders and community organisations.

10.3 Environmental baseline

Existing baseline

Study area description

10.3.1 Section 2 of this report provides a general overview of the Whittington to Handsacre area which includes data of specific relevance to socio-economics notably demographic and employment data. The following provides a brief overview in terms of employment, economic structure, labour market, and business premises availability within the area[39].

10.3.2 The Whittington to Handsacre area lies wholly within the area covered by Lichfield District Council.

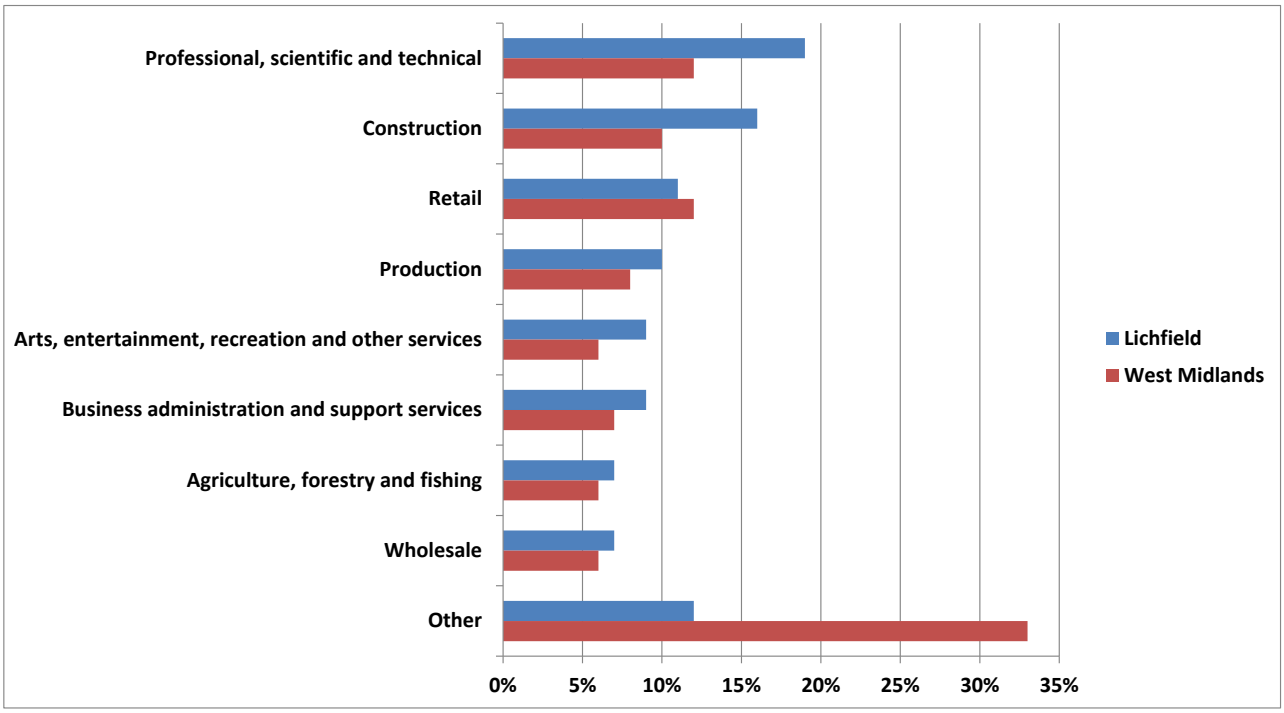
10.3.3 Where possible, baseline data has been gathered on demographic character areas (DCA)[40] to provide a profile of local communities. Volume 5: Appendix SE-002-107 shows the location of the DCA. The Whittington to Handsacre area contains three Demographic Character Areas – Lichfield East and Whittington DCA, Fradley DCA and Armitage and Handsacre DCA. The Lichfield East and Whittington DCA includes the eastern suburbs of Lichfield city, the settlement of Streethay, and Whittington and its rural hinterland. The Fradley DCA mostly covers an area immediately to the east of the route including the industrial area and settlement of Fradley South. The Armitage and Handsacre DCA includes the area just north of the edge of the Proposed Scheme, extending just beyond the parish boundary; however, given its proximity to the route and concentration of settlement, this DCA has been included for contextual purposes.

Business and labour market

10.3.4 The largest business sector in Lichfield District in 2011 was professional, scientific and technical services which accounts for a larger proportion (at 19%) of businesses than the West Midlands region average (12%) and the English average (14%). Lichfield District also has a higher proportion of construction sector businesses than is typical (at 16% compared to 10%) in the region[41]. This is shown in Figure 6[42].

[39] Further information on the socio-economics baseline, with regard to business and labour market profile, within the area is contained in the Volume 5: Appendix SE-001-000.
[40] DCA have been determined through an understanding of local context and aim to be aligned as closely as possible to groups of lower super output areas (LSOAs).
[41] Office for National Statistics (ONS) (2012), *UK Business: Activity, Size and Location 2011.* Please note 2011 data has been used to provide an appropriate comparison with 2011 Census data.
[42] The figure presents the proportion of businesses within each business sector in the borough but not the proportion of employment by sector.

Figure 6: Business sector composition in Lichfield District Council and West Midlands[43] [44]

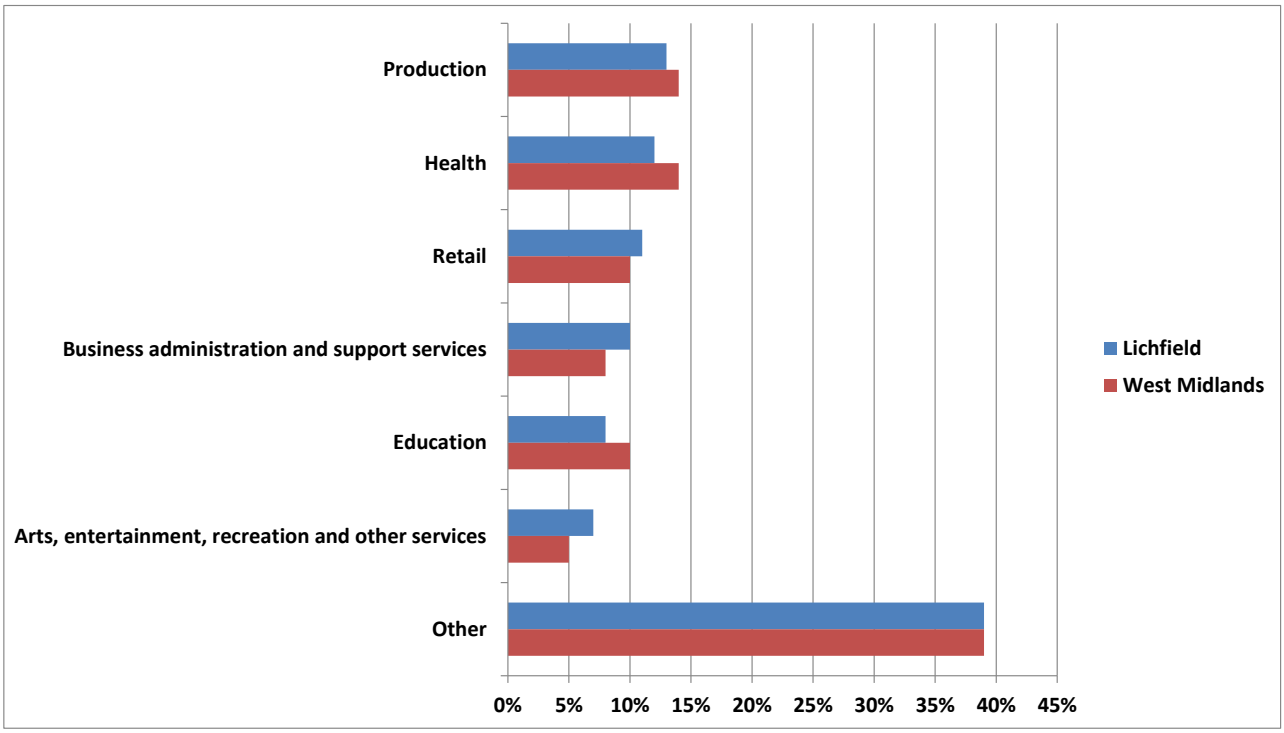


10.3.5 Approximately 40,000 people worked in Lichfield District while 7,000 were employed within the Lichfield East and Whittington DCA, 3,100 in Fradley DCA and 200 in Armitage and Handsacre DCA[45].

10.3.6 The sectors with the highest proportion of employment in Lichfield were production (13%) and health (12%). For production[46] this is less than the proportion for the West Midlands (14%) and higher than for England (10%) while for health this is lower than the West Midlands average (14%) and England average (12%). A further key sector for Lichfield was retail which at 11% is higher than the average for the West Midlands and England (both 10%). This is shown in Figure 7. The sector makeup varies between DCA. The largest employment sector in Lichfield East and Whittington DCA was business administration and support services (19%), in Fradley DCA it was retail (26%) and Armitage and Handsacre DCA it was education (20%).

[43] 'Other' includes motor trades; transport and storage; finance and insurance; property; public administration and defence; and education.
[44] ONS (2012), *UK Business: Activity, Size and Location 2011*, ONS, London.
[45] ONS (2012), *Business Register and Employment Survey 2011*, ONS, London.
[46] Production, as per ONS definition, is comprised of the mining, quarrying and utilities, and manufacturing sectors.

Figure 7: Proportion of employment by industry in Lichfield District Council and West Midlands[47] [48]



10.3.7 According to the 2011 Census[49], the employment rate[50] within the Lichfield District in 2011 was 66% (49,000 people) which is higher than that recorded for both the West Midlands (62%) and England (65%). The employment rate for Lichfield East and Whittington DCA was 66%, for Fradley DCA it was 73% and for Armitage and Handsacre DCA was 68%. In 2011 unemployment in Lichfield District was 6% which was lower than for the West Midlands (9%) and England (7%). The unemployment rate for Fradley DCA was 4%, for Lichfield East and Whittington DCA was 5% and for Armitage and Handsacre DCA it was 6%.

10.3.8 According to the 2011 Census, 28% of Lichfield residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 23% in West Midlands and 27% in England, while 22% of these residents had no qualifications which was lower than that recorded for the West Midlands (27%) and the same as the average for England (23%). In Lichfield East and Whittington DCA 36% of residents aged 16 and over were qualified to NVQ4 compared to 37% in Fradley DCA and 22% in Armitage and Handsacre DCA. In Lichfield East and Whittington DCA 17% of residents had no qualifications compared to 13% in Fradley DCA and 25% in Armitage and Handsacre DCA.

10.3.9 Lichfield East and Whittington DCA and Fradley DCA have skills levels above the regional and national averages while Armitage and Handsacre DCA has skills levels closer to the regional and national averages. Each DCA has a different employment focus with Lichfield East and Whittington DCA being focused in business

[47] 'Other' includes agriculture, forestry and fishing; construction; motor trades; wholesale; information and communication; finance and insurance; property; and public administration and defence.
[48] ONS (2012), *Business Register and Employment Survey 2011*, ONS, London.
[49] ONS (2012), *Census 2011*, ONS, London.
[50] The proportion of working age (16-74 years) residents that is in employment. Employment comprises the proportion of the total resident population who are 'in employment' and includes full-time students who are employed.

administration and support services, Fradley DCA being focused in retail and Armitage and Handsacre DCA being focused in education.

Property

10.3.10 Average vacancy rate for industrial and warehousing property in Lichfield District Council area in July 2013 has been assessed as 28% based on marketed space against known stock[51]. Overall, this suggests a good availability of alternative accommodation.

Future baseline

Construction (2017)

10.3.11 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. Implementation of all outstanding development consents and land allocations would result in approximately an additional 3,900 jobs[52] by 2017. 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.

Operation (2026)

10.3.12 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2026. There are no consents or allocations in this local area which are expected to accommodate additional material employment between 2017 and 2026.

10.4 Effects arising during construction

Avoidance and mitigation measures

10.4.1 In order to avoid or minimise the environmental impacts during construction, the Proposed Scheme design includes provisions to maintain access to businesses during the construction phase.

10.4.2 The draft Code of Construction Practice (CoCP) (see Volume 5: Appendix CT-003-000) includes a range of provisions that will help mitigate socio-economic effects associated with construction within this local area, including:

- 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 (draft CoCP Section 5);
- reducing nuisance through sensitive layout of construction sites(draft CoCP Section 5);
- applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses) (draft CoCP Section 13);

[51] 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).
[52] Potential employment has been estimated through employment floor space and the Homes and Communities Agency (HCA) *Employment Densities Guide 2nd Edition* (2010). The estimate is calculated using standard employment density ratios and estimates of floor areas.

- contractors will be required to monitor and manage flood risk and other extreme weather events which may affect socioeconomic resources during construction (draft CoCP, Sections 5 and 16); and
- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (draft CoCP Section 14).

Assessment of impacts and effects

Temporary effects

Change in business amenity value

10.4.3 No non-agricultural businesses[53] have been identified within this area which are expected to experience significant amenity effects as a result of the Proposed Scheme.

Isolation

10.4.4 No non-agricultural businesses have been identified within this area which are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

10.4.5 Construction compounds will consist of three main compounds at Cappers Lane, A515 Lichfield Road and Handsacre and twenty civil engineering satellite compounds (including one construction siding) and four railway installation satellite compounds. The use of these sites will result in the creation of up to 3,600 person years of construction employment opportunities[54], or approximately 360 full-time equivalent jobs[55], 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 overall impact of the direct construction employment creation is described as part of the route wide assessment (see Volume 3).

10.4.6 Direct construction employment created by the Proposed Scheme could also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers. The impact of this indirect construction employment creation has been assessed as part of the route wide assessment (see Volume 3).

Cumulative effects

10.4.7 No committed developments have been identified that are considered to interact with the Proposed Scheme.

10.4.8 Cumulative effects arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are assessed and reported as part of the route-wide assessment (see Volume 3).

[53] Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.
[54] 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.
[55] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

Permanent effects

Businesses

10.4.9 Businesses directly affected, i.e. those that lie within land which will be used for the construction of the Proposed Scheme, are reported in groups where possible to form defined resources, based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier or that similar businesses/resources are clustered together.

10.4.10 In all, three business accommodation units within the area will be directly impacted upon by the Proposed Scheme; the Whittington Heath Golf Club, airfield buildings near Streethay and an entertainment business (paint ball facility) at Ravenshaw Wood. However, from an employment perspective, no significant direct effects on non-agricultural employment[56] have been identified within the area.

10.4.11 It is estimated that land required for the construction of the Proposed Scheme will result in the displacement or possible loss of approximately 50 jobs[57] within this area. Taking into account the availability of alternative premises and the total employed within the district (approximately 40,000), the displacement or possible loss of jobs is considered to be modest compared to the scale of economic activity and opportunity in the area.

Cumulative effects

10.4.12 No committed developments have been identified that are considered to interact with the Proposed Scheme.

10.4.13 Cumulative effects arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are assessed and reported as part of the route-wide assessment (see Volume 3).

Other mitigation measures

10.4.14 The above assessment has concluded that there are no significant adverse effects arising during construction in relation to businesses directly affected by the Proposed Scheme.

10.4.15 Businesses displaced by the Proposed Scheme will be fully compensated within the provisions of the National Compensation Code. HS2 Ltd recognises the importance of displaced businesses being able to relocate to new premises and will therefore provide additional support over and above statutory requirements to facilitate this process.

10.4.16 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents along the line of route in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that fuels further economic growth across the UK.

[56] Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.
[57] Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency (HCA) *Employment Densities Guide 2nd Edition* (2010). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary significantly from actual employment at the sites.

Summary of likely residual significant effects

10.4.17 There are no significant effects arising during construction.

10.5 Effects arising during operation

Avoidance and mitigation measures

10.5.1 No mitigation measures are proposed during operation within this area.

Assessment of impacts and effects

Resources with direct effects

10.5.2 There are no resources considered likely to experience significant direct effects during the operational phase of the Proposed Scheme within this area.

Change in business amenity

10.5.3 No non-agricultural businesses have been identified within this area which are expected to experience significant amenity effects as a result of the Proposed Scheme.

Operational employment

10.5.4 Operational employment will be created at locations along the route including stations, train crew facilities and infrastructure/maintenance depots. These are considered unlikely to be accessed by residents of this area.

10.5.5 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.

10.5.6 The impact of operational employment creation has been assessed as part of the route-wide assessment (see Volume 3).

Other mitigation measures

10.5.7 The assessment has concluded that operational effects within the area will be either negligible or beneficial and therefore mitigation is not required.

Summary of likely residual significant effects

10.5.8 There are no significant effects identified in the assessment that will arise during operation.

11 Sound, noise and vibration

11.1 Introduction

11.1.1 This section reports the assessment of the likely noise and vibration significant effects arising from the construction and operation of the Proposed Scheme for the Whittington to Handsacre area on:

- people, primarily where they live ('residential receptors') in terms of a) individual dwellings and b) on a wider community basis, including any shared community open areas[58]; 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'[59].

11.1.2 The assessment of likely significant effects from noise and vibration on agricultural, community, ecological or heritage receptors and the assessment of tranquillity are presented in Sections 3, 5, 6, 7 and 9 of this report respectively.

11.1.3 In this assessment 'sound' is used to describe the acoustic conditions which people experience as a part of their everyday lives. The assessment considers how those conditions may change through time and how sound levels and the acoustic character of community areas 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.

11.1.4 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 e.g. resulting from changes in traffic patterns on existing roads or railways that result from the construction or operation of the Proposed Scheme.

11.1.5 This section sets out the means to avoid or reduce the adverse effects that may occur.

11.1.6 The approaches to assessing sound, noise and vibration and appropriate mitigation are outlined in Volume 1 and scope and methodology are defined in the following documents:

- Scope and Methodology Report (SMR) (Appendix CT-001-000/1); and
- SMR addendum (Appendix CT-001-000/2).

11.1.7 More detailed information and mapping regarding the sound, noise and vibration

[58] 'shared community open areas' are those that the emerging 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 to local green space) that is nearby.

[59] Quiet areas are defined in the Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity (further information on tranquillity is provided in Section 9).

assessment for Whittington to Handsacre is available in the relevant appendices in Volume 5:

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000);
- sound, noise and vibration baseline (Appendix SV-002-022);
- sound, noise and vibration construction assessment (Appendix SV-003-022);
- sound, noise and vibration operation assessment (Appendix SV-004-022); and
- Map Series SV-01, SV-02, SV-03 and SV-04 (Volume 5, Sound, noise and vibration Map book).

11.2 Environmental baseline

Existing baseline

11.2.1 The area is predominantly rural and characterised by small villages, hamlets and isolated properties, but is also close to several major settlements. The A38 is the main road in the area, connecting Birmingham and Sutton Coldfield in the south to Lichfield and Fradley before continuing north to Burton upon Trent and Derby. The A515 is another important road, linking Lichfield with Kings Bromley, acting as an arterial route through the surrounding countryside to the west of Alrewas and Burton on Trent. The M6 Toll is located on the western edge of the study area along with the West Coast Main Line, which bisects the village of Handsacre. Close to these roads and railways high baseline sound levels are experienced during the daytime. Night-time levels remain high in the vicinity of the A38. In areas further from these sources, lower baseline sound levels are experienced.

11.2.2 South of the A38 and around the villages of Whittington and Huddlesford the area is predominantly arable farm land with a number of isolated residences and farms. The noise climate is dominated by road traffic noise from the A51 and A38, as well as traffic on local roads (Darnford Lane, Cappers Lane and Common Lane) with frequent contributions from natural sound sources (e.g. tree rustle, bird song and livestock). Typical baseline noise levels range from 55 to 60dB[60] during daytime, reducing to 50 to 55dB[61] at night-time in these areas.

11.2.3 In the residential area of Streethay, west of the A38, the sound environment is characterised by transportation noise sources, namely the A38, the A5127 (Trent Valley Road) and the South Staffordshire Line which bounds the southern edge of the village. North of the A38 and south of Fradley, the character is urban fringe and is dominated by major business and industrial uses. The sound environment is dominated by industrial and transportation noise. Typical baseline noise levels in Streethay are 55 to 60dB during the day and 50 to 55dB at night.

11.2.4 Between Curborough and Handsacre the area is rural in character, with large areas of agricultural land used for both livestock and arable farming. The noise climate is

[60] Quoted dB values at residential areas refer to the free-field 16 hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, $L_{pAeq,16hr}$.
[61] Night-time sound levels refer to the free-field 8 hour night-time (23:00 to 07:00) equivalent continuous sound pressure level, $L_{pAeq,8hr}$.

dominated by natural sound sources (e.g. tree rustle, bird song and livestock) and agricultural activity noise with contributions from nearby transportation sources namely the A515, Wood End Lane, A513, and distant railway noise from the West Coast Main Line. In this region, the typical baseline daytime noise levels range from 60 to 65dB close to transport corridors to 50dB in the most isolated areas. At night, the baseline noise level is generally 45 to 50dB.

11.2.5 In the residential areas of Handsacre, the sound environment is dominated by noise from the presence of trains along the West Coast Main Line together with community noise (local road traffic noise and normal every day residential activities). The typical baseline noise levels in Handsacre are 55 to 60dB during the day and 40 to 45dB at night.

11.2.6 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in Volume 5: Appendix SV-002-022.

11.2.7 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration[62]. Vibration at all receptors from the Proposed Scheme has therefore been assessed using specific thresholds, below which receptors will not be affected by vibration. Further information is provided in Volume 1, Section 8.

Future baseline

11.2.8 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. 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[63], tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

11.2.9 The assessment of noise from construction activities assumes a baseline year of 2017 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 (2012/13) and the future baseline year of 2017. The assessment of noise from construction traffic assumes a baseline year of 2021, representative of the middle of the construction period when the construction traffic flows are expected to be at their peak. Further information can be found in the Traffic and Transport assessment.

Operation (2026)

11.2.10 The assessment is based upon the predicted change in sound levels that result from 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 2012/2013. Where significant effects were identified on this basis, the effects have been assessed using a baseline year of 2026 to coincide

[62] Further information is available in the Volume 5: Appendix SV-001-000, the SMR and its Addendum.
[63] Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

with the proposed start of passenger services. The future baseline is for the sound environment that would exist in 2026 without the Proposed Scheme.

11.3 Effects arising during construction

Local assumptions and limitations

Local assumptions

11.3.1 The construction arrangements that form the basis of the assessment are presented in Section 2.3 of this report.

11.3.2 The following activities will need to be undertaken during the evening and night-time for reasons of safety, engineering practicability or to reduce the impact on existing transport:

- movement of trains into and out of the temporary rail sidings at Streethay.

11.3.3 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.

11.3.4 Although it is anticipated that there may be some night-time working during works to cross or tie into existing roads and railways, it is expected that the noise effects would be limited in duration and would hence not be considered 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 CoCP.

Local limitations

11.3.5 In this area, there are a number of locations where the land or property owners did not permit baseline sound level monitoring to be undertaken at their premises. However, sufficient information has been obtained to undertake the assessment. Further information is set out in Volume 5: Appendix SV-003-022.

Avoidance and mitigation measures

11.3.6 The assessment assumes the implementation of the principles and management processes set out in the draft CoCP which are:

- Best Practicable Means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA) will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties;
- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings; and then
  - screening: for example local screening of equipment or perimeter hoarding;

- where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary re-housing will be offered in accordance with the draft CoCP's noise insulation and temporary re-housing policy;
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of 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 will be made available to the local authorities; and
- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

11.3.7 In addition to this mitigation, taller screening as described in the draft CoCP[64] has been assumed along edge of the construction site boundary adjacent to the community at Handsacre, and in the vicinity of Handsacre Primary school, Ellfield House, Mill Farm, The Manor House, Ravenshaw Cottage, and Shaw Lane Farm.

11.4 Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.4.1 The mitigation measures will reduce noise inside all dwellings such that it does not reach a level where it would significantly affect[7] residents.

Residential receptors: direct effects –communities

11.4.2 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

11.4.3 In locations with lower existing sound levels[65], construction noise adverse effects[7] 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. These adverse effects are considered to be significant when assessed on a community basis taking account of the local context[66].

11.4.4 In this area, the mitigation measures reduce the effects of outdoor construction noise on the acoustic character around the local residential communities such that the adverse effects identified are considered not to be significant.

[64] As described in the draft CoCP, provided as necessary by solid temporary hoarding, temporary earth stockpiles, screening close to the activities or other means to provide equivalent noise reduction.
[65] Further information is provided in Volume 5: Appendix SV-001-000.
[66] Further information is provided in Volume 5: Appendix SV-001-000 and SV-003-022.

Residential receptors: indirect effects

11.4.5 Significant noise effects on residential receptors arising from construction traffic are unlikely to occur in this area.

Non-residential receptors

11.4.6 Significant construction noise or vibration effects on non-residential receptors are unlikely to occur in this area.

Cumulative effects from the Proposed Scheme and other committed development

11.4.7 This assessment has considered the potential cumulative construction noise effects of the proposed scheme and other committed developments[67]. In this area, there is no development that would be built 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.

Summary of likely residual significant effects

11.4.8 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it is does not reach a level where it would significantly affect[7] residents.

11.4.9 The measures also reduce the adverse effects of outdoor construction noise on the acoustic character around the local residential communities such that the effects are not considered to be significant.

11.5 Effects arising during operation

Local assumptions and limitations

11.5.1 The effects of noise and vibration from the operation of the Proposed Scheme have been assessed based on the likely train flows on each section including, where it would lead to higher noise levels, Phase Two services. Trains are expected to be 400m long during peak hours and a mix of 200m and 400m long trains at other times.

11.5.2 The expected passenger service frequency for both Phase One, and Phase One with Phase Two services are described in Volume 1[68]. As a reasonable worst case, this assessment for the route up to the connection to Manchester is based upon the service pattern for Monday to Saturday including Phase Two services. For the section of the route between the connection to Manchester and the connection to the WCML at Handsacre, the reasonable worst case is based upon the service pattern for Monday to Saturday for Phase One services only. The number of services on this section of the route would reduce when HS2 Phase Two become operational.

11.5.3 Passenger services will start at or after 05:00 from the terminal stations and in this area will progressively increase to the number of trains per hour in each direction on the main lines set out in Table 21. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after

[67] Refer to Volume 5: Appendix CT-004-000.
[68] The change in noise and vibration effects between the different passenger services is assessed in Volume 1.

21:00 and the last service will arrive at terminal stations by 24:00. Train speeds are shown in Table 21.

Table 21: Train flows and speeds

Description of line	Time period for peak daytime flows	Number of trains per hour in each direction with Phase Two services (Phase One only trains per hour in each direction is set out in brackets)	Speed
South of connection to Manchester spur	07:00-21:00	12 (8)	330kph for 90% of services, 360kph for 10% of services
North of connection to Manchester Phase Two (Handsacre link to WCML)	07:00-21:00	1 (8)	As above, slowing to 175kph at the connection with WCML at Handsacre

Avoidance and mitigation measures

11.5.4 The development of the Proposed Scheme has, as far as reasonably practicable, kept the alignment away from main communities. This has protected many communities from likely significant noise or vibration effects.

Airborne noise

11.5.5 HS2 trains will be quieter than the relevant current European Union specifications. This will include reduction of aerodynamic noise from the pantograph that otherwise would occur above 300kph (186mph) with current pantograph designs, drawing on proven technology in use in East Asia. The track will be specified to reduce noise, as will the maintenance regime. Overall these measures would reduce noise emissions by approximately 3dB at 360kph compared to a current European high speed train operating on the new track. Further information is provided in Volume 5: Appendix SV-001-000.

11.5.6 To avoid or reduce significant airborne noise effects, the Proposed Scheme incorporates noise barriers in the form of landscape earthworks, noise fence barriers and / or 'low-level' barriers on viaducts. Noise barrier locations are shown on Volume 2: Map Book – Sound, noise and vibration Map series SV-05.

11.5.7 Generally, the assessment has been based on noise barriers having a noise reduction performance equivalent to a noise fence barrier with a top level 3m above the top of the rail, which is acoustically absorbent on the railway side, and which is located 5m to the side of the outer rail. In practice, barriers may differ from this description, but will provide the same acoustic performance. For example, where noise barriers are in the form of landscape earthworks they will need to be higher above rail level to achieve similar noise attenuation to a 3m barrier because the crest of the earthwork will be further than 5m from the outer rail.

11.5.8 The Proposed Scheme incorporates 'low-level' barriers into the design of viaducts. Where needed to avoid or reduce significant airborne noise effects, these barriers are designed to provide noise reduction that is equivalent to a 2m high absorptive noise barrier located on the parapet of the viaduct. Locating these 'low-level' barriers close to the rail also reduces visual impact and limits the mass of the viaduct itself.

11.5.9 Noise effects are reduced in other locations along the line 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 these barriers is shown on Volume 2: Map Book – Sound, noise and vibration, Map series SV-05.

11.5.10 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 (for further information please see Volume 5: Appendix SV-001-000).

11.5.11 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996[69] (the Regulations). The assessment reported in this section provides an estimate of the buildings that are likely to qualify under the Regulations. Qualification for noise insulation under the Regulations will be identified and noise insulation offered at the time that the Proposed Scheme becomes operational.

11.5.12 Where 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.

11.5.13 Following Government's emerging National Planning Practice Guidance[70] where the noise from the use of the Proposed Scheme measured outside a dwelling exceeds the Interim Target defined by the WHO Night Noise Guidelines for Europe[71], residents are considered to be significantly affected by the resulting noise inside their dwelling. The effect on people at night due to the maximum sound level as each train passes has also been assessed[72]. The Interim Target is a lower level of noise exposure than the Regulations trigger threshold for night noise. In these particular circumstances, where night-time noise levels for the use of new or additional railways authorised by the Bill are predicted following the methodology set out in the Regulations to exceed 55dB[73], or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion4, noise insulation will be offered for these additional buildings.

Ground-borne noise and vibration

11.5.14 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.5.15 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified one residential dwelling close to the

[69] Her Majesty's Stationery Office (1996), The Noise Insulation (Railways and Other Guided Transport Systems) Regulations, London.
[70] National Planning Practice Guidance – Noise http://planningguidance.planningportal.gov.uk.
[71] World Health Organization (2010), Night-time Noise Guidelines for Europe.
[72] 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).
[73] Equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings

Proposed Scheme, The Manor, Streethay, where noise would exceed the daytime trigger threshold set in the Regulations. It is therefore estimated that this building is likely to qualify for noise insulation under the Regulations. This is indicated on Volume 5: Map Book - Sound, noise and vibration, Map series SV-05.

11.5.16 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified a number of residential buildings close to the Proposed Scheme where the daytime forecast noise level does not exceed the threshold set in the Regulations but the forecast night-time noise level would exceed the World Health Organization's Interim Target of 55dB, or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion. It is estimated that these buildings will also be offered noise insulation as described previously in the Avoidance and mitigation measures section. These buildings are indicated on Volume 5: Map Book - Sound, noise and vibration, Map series SV-05:

- Streethay Farm, Burton Road;
- Mill Farm, Lichfield; and
- Ravenshaw House, Curborough.

11.5.17 The mitigation measures including noise insulation will reduce noise inside all dwellings such that it will not reach a level where it would significantly affect residents.

Residential receptors: direct effects –communities

11.5.18 The avoidance and mitigation measures in this area will avoid significant airborne noise effects on the majority of receptors, and at the following communities:

- Whittington (except as noted in Table 22);
- Streethay;
- Lichfield; and
- Handsacre (except as noted in Table 22).

11.5.19 Taking account of the envisaged mitigation, Map Series SV-05 (Volume 2 Map book) shows the long term 40dB[74] 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[75]. In general, below these levels adverse effects are not expected.

11.5.20 Above 40dB during the night and 50dB during the day the 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

[74] Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$).
[75] 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.

effects forecast for the operation of the scheme are presented on Map Series SV-05 (Volume 2 Map Book).

11.5.21 The changes in noise levels are likely to affect the acoustic character of the area such that there is a perceived change in the quality of life and are considered to be significant when assessed on a community basis taking account of the local context[76].

11.5.22 The direct adverse effects[65] on the areas of the residential communities identified in Table 22 are considered to be significant.

Table 22: Direct adverse effects on residential communities and shared open areas that are considered significant on a community basis

Significant effect number (see map series SV-05)	Source of significant effect	Time of day	Location and details
OSV22-C01	Airborne noise increase from new train services	Daytime and night-time	Around 10 dwellings in the north of Whittington in the vicinity of Darnford Lane, Marsh Lane and Lichfield Road. 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 reduces on those that are located further from the railway would be a minor effect. There is shared open space adjacent to these dwellings that would also be adversely affected in this community area.
OSV22-C02	Airborne noise increase from new train services (Phase One operation only)	Daytime and night-time	Approaching 80 dwellings on the south of Handsacre, closest to the WCML and the tie in to Proposed Scheme in the vicinity of Chestnut Close, Rowan Drive, Warren Croft, Barn Road, Lichfield Road and Millcroft Way. 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 a moderate effect. There is shared open space located just off Chestnut Close that would also be adversely affected in this community area.

Residential receptors: indirect effects

11.5.23 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

11.5.24 The assessment of operational noise and vibration indicates that no significant effects are likely.

11.5.25 The assessment of effects on non-residential receptors has been undertaken on a worst case basis. Further information can be found in Volume 5: Appendix SV-004-022.

Non-residential receptors: indirect effects

11.5.26 The assessment of operational noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in this area.

[76] Further information is provided in SV-001-000 and SV-004-022.

Summary of likely significant residual effects

11.5.27 The mitigation measures reduce noise inside all dwellings such that it does not reach a level where it would significantly affect[65] residents.

11.5.28 The avoidance and mitigation measures in this area will avoid noise and vibration adverse effects[65] on the majority of receptors and communities including shared open areas.

11.5.29 Taking account of the avoidance and mitigation measures and the local context, the residual permanent noise adverse effects[65] on the acoustic character of the community in the south of Handsacre closest to the WCML and its shared open space is considered significant.

11.5.30 On a reasonable worst case basis a significant noise effect has been identified on Handsacre Primary School.

11.5.31 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. The outcome of these activities will be reflected in the Environmental Minimum Requirements.

12 Traffic and transport

12.1 Introduction

12.1.1 This traffic and transport section describes the likely impacts on all forms of transport and the consequential effects on transport users arising from the construction and operation of the Proposed Scheme through the Whittington to Handsacre area.

12.1.2 With regard to traffic and transport, the main issues are increased traffic as a result of implementation of the Proposed Scheme, road realignments and consequential temporary road closures, and temporary and permanent realignments of Public Rights of Way (PRoW).

12.1.3 The effects on traffic and transport have been assessed quantitatively, based on baseline traffic conditions and future projection scenarios.

12.1.4 A detailed report on traffic and transport and surveys undertaken within the area is contained in the Volume 5 Appendix TR-001-000, Transport Assessment.

12.1.5 Figure 2 shows the location of the key transport infrastructure in this area.

12.1.6 Engagement has been undertaken with the key transport authorities, including Staffordshire County Council (SCC) and the Highways Agency (HA).

12.2 Scope, assumptions and limitations

12.2.1 The assessment scope, key assumptions and limitations for the traffic and transport assessment are set out in Volume 1, the SMR (see Volume 5: Appendix CT-001-000/1) and the SMR Addendum (see Volume 5: Appendix CT-001-000/2). This report follows the standard assessment methodology.

12.2.2 The study area covers the roads potentially affected by the scheme including sections of the A38, A515 Lichfield Road, Lichfield Road (Whittington), Darnford Lane, Cappers Lane, Broad Lane, Wood End Lane, Netherstowe Lane and Shaw Lane.

12.2.3 A number of transport modelling tools have been used to inform the assessment including the Department for Transport's traffic forecasting tool, Trip End Model Presentation Program (TEMPRO), for forecast road traffic growth in the area. The assessment covers the morning (08:00-09:00) and evening (17:00-18:00) peak periods for an average weekday.

12.3 Environmental baseline

Existing baseline

12.3.1 Existing conditions in the area have been determined through site visits, specially commissioned transport surveys, and liaison with Staffordshire transport authorities and stakeholders to source information on public transport, highway flows, PRoW and accident data.

12.3.2 Traffic surveys of all roads crossing the route or potentially affected were undertaken in June, July and November 2012, with additional surveys undertaken in May and June 2013, comprising junction turning counts and queue surveys, as well as automatic

traffic counts. This was supplemented by traffic and transport data obtained from other sources, including from the Highways Agency and survey information held by the local authorities. The highway peak hours in the study area were 08:00-09:00 and 17:00-18:00.

12.3.3 PRoW surveys were undertaken in August and September 2012 to establish the nature of the PRoW and their usage by pedestrians, cyclists and riders (non-motorised users). The surveys included all PRoW and roads that will be crossed by the route of the Proposed Scheme and any additional PRoW and roads that will be affected by the Proposed Scheme. The Proposed Scheme will affect seven PRoW within the Whittington to Handsacre area and will cross each of these. Five of the PRoW were used by less than ten people a day. The routes with the greatest usage were Whittington Footpath 16 (in Whittington Common golf course) with 26 users per day and Streethay Footpath 6 (near Hill Farm) with 14 users per day. The Proposed Scheme will not cross any roads with footways.

12.3.4 There is one strategic route that passes through the area; the A38, which travels broadly in a south-west/north-east direction past Lichfield, Streethay and Fradley. There are two partial junctions to the south and north of Streethay: the A5192 Cappers Lane provides access to south-facing slip roads; and the A5127 Burton Road provides access to north facing slip roads. There is a junction at Wood End Lane to serve the Fradey area. To the south, the A38 has a junction with the A5026 and the A5148 and then continues south to the A5 and M6 Toll at Carroway Head.

12.3.5 The main local roads affected by the Proposed Scheme, from south to north, will be Lichfield Road (locally also known as Whittington Common Road), which runs in a broadly west/east direction and connects the A51 Tamworth Road with Church Street just to the west of Whittington; Darnford Lane, which has a west/east alignment and connects Lichfield with Whittington; Cappers Lane, which runs in a broadly north-west/south-east direction and connects the east of Lichfield with Church Street just outside of Whittington; Broad Lane (locally also known as Park Lane), which has a west/east alignment and links Cappers Lane west of Huddlesford with Burton Road in the north of Whittington; Wood End Lane, which runs in a west/east alignment and connects the A515 Lichfield Road with the A38 east of Fradley Business Park at Hilliards Cross; the A515 Lichfield Road (locally also known as Tewnal's Lane), which has a broadly south-west/north-east alignment and links the A51 Stafford Road with Kings Bromley; Netherstowe Lane, which connects east Lichfield with Curborough and Wood End Lane in the north-east; and Shaw Lane, which lies to the south-east of Handsacre and travels in a south-west/north-east direction, linking the B5014 Lichfield Road with the A515 Lichfield Road.

12.3.6 Safety and accident data for the road network subject to assessment has been obtained from SCC for the three year period up to 2012. This has been assessed and any identified clusters have been examined. Analyses of the data have shown no accident clusters, although a total of 14 accidents occurred on the A38, over a stretch of approximately 2.3km.

12.3.7 There are four public bus services that pass through the Whittington to Handsacre area. These services provide a combined service frequency of up to five buses per

hour. The communities served by bus services that will be affected by the Proposed Scheme include:

- bus number 765 and 785 – Whittington and Lichfield to Tamworth and Nuneaton; and
- bus number 7 and X12 – Streethay, Fradley and Lichfield to Burton upon Trent and Sutton Coldfield.

12.3.8 The Proposed Scheme will cross the existing West Coast Main Line (WCML) between Lichfield and Tamworth and will connect to the WCML at Handsacre, as described in section 2 of this report. This line is used by Virgin Train services from London Euston to Holyhead, Wrexham General, Liverpool Lime Street, Manchester Piccadilly and Glasgow Central. Virgin operates a minimum of seven rail services per hour to these destinations. The WCML is also used by the London Euston to Crewe services operated by London Midland, with an average off peak frequency of one service per hour. The WCML is also extensively used for freight services.

12.3.9 The Proposed Scheme will also cross the South Staffordshire Line north of Lichfield, which is a freight-only route and only used by the Cross-City Line passenger services (operated by London Midland) as an alternative route when there is engineering disruption.

12.3.10 There are two navigable waterways that will be directly affected by the Proposed Scheme in the Whittington to Handsacre area, the Trent and Mersey Canal and the Coventry Canal. A usage of five boats per day has been identified during a survey undertaken of the Trent and Mersey Canal. The Proposed Scheme will also cross the end of the Wyrley and Essington Canal, which is a short spur off the Coventry Canal.

Future baseline

12.3.11 The future baseline traffic volumes have been calculated by applying growth factors based on TEMPRO for the years of assessment 2021 and 2026 and on extrapolation to 2041, also taking account of any major locally consented schemes. No other changes to the traffic and transport baseline are anticipated in this area.

Construction

12.3.12 Individual construction activities have been assessed against 2021 baseline traffic flows, irrespective of when they occur during the construction period. Future baseline traffic volumes in the peak hours are forecast to grow by around 11% by 2021 compared to 2012.

Operation (2026)

12.3.13 Future baseline traffic volumes in the peak hours are forecast to grow by around 18% by 2026 compared to 2012.

Operation (2041)

12.3.14 Future baseline traffic volumes in the peak hours are forecast to grow by around 38% by 2041 compared to 2012.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The following measures (as discussed in Section 2) have been included as part of the engineering design of the Proposed Scheme in this area and will avoid or reduce effects on transport users:

- construction materials and equipment will be transported along the haul road adjacent to the Proposed Scheme alignment, where reasonably practicable, to reduce lorry movements on the public highway;
- the majority of roads crossing the Proposed Scheme will be kept open during construction resulting in limited diversions of traffic onto alternative routes;
- the Proposed Scheme will include permanent realignments or diversions of PRoW, or temporary re-routeing as necessary, to reduce loss of connectivity;
- road closures will be limited to overnight and/or weekends;
- HGV routeing along the strategic road network and using designated routes for access, as shown in map TR-03-107 (Volume 5, Map Book, Traffic and Transport);
- materials will be transported by rail to reduce the potential numbers of HGV trips that would otherwise be made on the highway network; and
- provision of on-site accommodation and welfare facilities to reduce daily travel by site workers.

12.4.2 The draft Code of Construction Practice (CoCP) (see Volume 5: Appendix CT-003-000) includes measures that seek to reduce the impacts and effects of deliveries of construction materials and equipment, including reducing construction lorry trips during peak background traffic periods. The draft CoCP includes HGV management and control measures.

12.4.3 Where reasonably practicable, the number of private car trips to and from each site (both workforce and visitors) will be reduced by encouraging alternative modes of transport or vehicle sharing. This will be supported by an over-arching framework travel plan[77] that will require travel plans to be used along with a range of potential measures to mitigate the impacts of traffic and transport movements associated with construction of the Proposed Scheme. As part of this, a construction workforce travel plan will be put into operation with the aim of reducing workforce commuting by private car, especially sole occupancy car travel. Where reasonably practicable, this will encourage the use of sustainable modes of transport.

12.4.4 The measures in the CoCP will include clear controls on vehicle types, hours of site operation, and routes for heavy goods vehicles, to reduce the impact of road based construction traffic. In order to achieve this, generic and site specific traffic

[77] 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.

management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads, footpaths and other PRoW affected by the Proposed Scheme as necessary.

12.4.5 Specific measures will include:

- core site operating hours will be 08:00-18:00 on weekdays and 08:00-13:00 on Saturdays and site staff and workers will therefore generally arrive before the morning peak hour and depart after the evening peak hour (although the assessment has assumed that some of work journeys to the construction sites take place within the morning and evening peak hours to reflect a reasonable worst case scenario) (draft CoCP, Section 5); and
- excavated material will be reused wherever reasonably practicable along the alignment of the Proposed Scheme which will reduce the effects of construction vehicles on the public highway (draft CoCP, Section 15).

12.4.6 The need for rail possessions will be managed so that these take place for limited durations overnight and at weekends, where possible with only two of the four WCML tracks closed at any one time and services maintained.

Assessment of impacts and effects

Temporary effects

12.4.7 The following section considers the impacts on traffic and transport and the consequential effects resulting from construction of the Proposed Scheme.

12.4.8 The temporary traffic and transport impacts within this CFA will be:

- construction vehicle movements to and from the main compounds and satellite compounds;
- overnight closures of the Trent and Mersey Canal and the Coventry Canal to enable safe construction works to take place;
- rail possessions to construct the viaducts over the WCML and South Staffordshire line and the connection to the WCML;
- movement of material between the roadheads and the construction sidings;
- import of material by rail;
- road closures and associated overnight and/or weekend traffic diversions; and
- traffic management and overnight closures on the A38.

12.4.9 Construction vehicle movements required to construct the Proposed Scheme will include the delivery of plant and materials, movement of excavated materials and site worker trips.

12.4.10 Details of construction compounds are provided in Section 2.3. The duration of when there will be busy transport activity at each site is shown in Table 23. Some compounds only have traffic movements to other locations within the construction area. This table represents the periods when the construction traffic flows will be greater than 50% of the peak construction traffic flows. Also shown is the estimated

number of daily vehicle trips during the peak month of activity; the lower end of the range shows the average number of trips in the busy period and the upper end the range shows the peak month flows. The assessment scenario has assumed the peak month for the combination of activities, i.e. not necessarily the peak activity at each individual site.

Table 23: Typical vehicle trip generation for construction site compounds in this area

Compound type	Location	Access to/from compound	Indicative start / set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movement (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
Satellite	Lichfield Road Underbridge Satellite Compound	Lichfield Road / A51 / A5206 / A38	2018	1.5	4	30-35	35-40
Satellite	Darnford Lane Overbridge Satellite Compound	Track/haul route via Lichfield Road Underbridge Satellite Compound	2018	3	-	Few external movements	
Satellite	Cappers Lane Viaduct (South) Satellite Compound	Track/haul route via Cappers Lane Main Compound	2017	2	-	Few external movements	
Satellite	Cappers Lane Viaduct (North) Satellite Compound	Cappers Lane / A38	2017	2	23	50	25-35
Satellite	Cappers Lane Viaduct (West) Satellite Compound	Track/haul route via Cappers Lane Main Compound	2017	2	-	Few external movements	
Satellite	Cappers Lane Auto-transformer Satellite Compound	Cappers Lane / A38	2022	1	11	50-70	5
Satellite	Broad Lane Underbridge Satellite Compound	Track/haul route via Cappers Lane Main Compound	2018	2.5	-	Few external movements	
Main	Cappers Lane Main Compound	Cappers Lane / A38	2018	6	1	180-210	80-105
Satellite	Fulfen Wood Viaduct (south) Satellite Compound	Track/haul route via Cappers Lane Main Compound	2018	2.5	-	Few external movements	

Compound type	Location	Access to/from compound	Indicative start / set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movement (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
Satellite	Fulfen Wood Viaduct (north) Satellite Compound	Track/haul route via Streethay Construction Sidings	2018	2.5	-	Few external movements	
Sidings	Streethay Construction Sidings	Broad Lane / Cappers Lane / A38	2018	5	5	Few external movements	1550
Satellite	Streethay viaduct (south-east) Satellite Compound	Track/haul route via Cappers Lane Main Compound	2019	2	-	Few external movements	
Satellite	Streethay viaduct (north-east) Satellite Compound	Track/haul route via Cappers Lane Main Compound	2019	2	-	Few external movements	
Satellite	Streethay viaduct (south-west) Satellite Compound	Track/haul route via Cappers Lane Main Compound	2019	2	-	Few external movements	
Satellite	Streethay Viaduct (north-west) Satellite Compound	A38	2019	2	21	50	35-45
Satellite	Mare Brook package substation Satellite Compound	Nanscawen Road / Wood End Lane / A38	2022	<1	<1	Few external movements	
Roadhead	Nanscawen Road Roadhead	Wood End Lane to A38	2018	3	36	Few external movements	250
Satellite	Curborough Flyover Satellite compound	Wood End Lane to A38	2018	7	13	140-150	110-135
Roadhead	Wood End Lane Roadhead	Wood End Lane to A38	2019	3	36	Few external movements	1250
Satellite	Trent & Mersey Canal East Viaduct (south-east) Satellite Compound	Track/haul route via Curborough Viaduct Satellite Compound	2018	1	-	Few external movements	
Satellite	Lyntus auto-transformer station Satellite Compound	Wood End Lane to A38	2022	1	11	50-70	5

Compound type	Location	Access to/from compound	Indicative start / set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movement (months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/LGV	HGV
Satellite	Trent & Mersey Canal East Viaduct (north-east) Satellite Compound	Track/haul route via Curborough Viaduct Satellite Compound	2018	1	-	Few external movements	
Satellite	Trent and Mersey Canal West Viaduct (South-West) Satellite Compound	Wood End Lane to A38	2018	1	13	50	35
Satellite	Trent & Mersey Canal East Viaduct (north-west) Satellite Compound	Track/haul route via Trent and Mersey Canal West Viaduct (South-West) Satellite Compound	2018	1	-	Few external movements	
Main	A515 Lichfield Road Main Compound	A515 Lichfield Road	2018	5	26	1180-220	70-100
Main	Handsacre (A515) rail Systems Main Compound	A515 Lichfield Road	2021	6	25	120-125	10
Satellite	A515 Lichfield Road Underbridge Satellite Compound	Track/haul route via A515 Lichfield Road Main Compound	2018	1	-	Few external movements	
Satellite	Harvey's Rough flyover Satellite Compound	Track/haul route via A515 Lichfield Road main compound	2018	5	-	Few external movements	
Satellite	Shaw Lane Rail systems Satellite Compound	Shaw Lane / B5014 Lichfield Road / A515 Lichfield Road	2021	2	25	75-90	5

12.4.11 Details of the construction phasing are provided in Section 2.3. The construction assessment considers the traffic and transport impacts and effects in three peak periods of construction activity, based on the proposed phasing of the works. The peak periods have been identified as: month 31 (2018 Quarter 4) with 19 operational compounds; and months 27 to 30 (2018 Quarter 3 to Quarter 4) and month 35 (2019 Quarter 1) with 19 operational compounds. Where impacts are significant in any of these periods they are identified, together with the effects of other significant changes.

12.4.12 It is proposed that the A38 will provide the primary HGV access and egress route in this area.

12.4.13 Construction of the Proposed Scheme will result in changes in traffic flows from workers and construction vehicles accessing compounds, as well as from temporary road closures and diversions.

12.4.14 There will be restricted access arrangements and temporary, overnight and/or weekend closures on Lichfield Road (Whittington), Darnford Lane, Cappers Lane, Broad Lane, A38, A515 Lichfield Road and Wood End Lane (traffic management details can be found in section 2.3). The effects of these measures on traffic flows and delays to vehicle occupants, as a result of the diversions or traffic congestion[78], are considered not significant.

12.4.15 Construction of the Proposed Scheme is forecast to result in substantial increases in daily traffic flow (i.e. more than 30% for HGV or all vehicles), causing significant increases in traffic-related severance[79] for non-motorised users in the following locations:

- A38 from its junction with the A5 to the south of Lichfield to its junction with Wood End Lane to the north-east of Lichfield at Hilliards Cross (moderate adverse effect due to HGV traffic flow increase);
- Cappers Lane from its junction with the A38 eastwards to the proposed satellite compound access to the east of the HS2 alignment, just beyond Mill Farm (major adverse effect due to HGV traffic flow increase);
- A5192 Cappers Lane from A38 junction westwards to the roundabout with Austin Cote Lane, due to increase in HGVs added to low baseline traffic (moderate adverse effect due to all-vehicle traffic flow increase);
- Broad Lane from its junction with Cappers Lane eastwards to just beyond the WCML (major adverse effect due to HGV traffic flow increase); and
- Wood End Lane from its junction with the A38 at Hilliards Cross to the junction with Nanscawen Road in Fradley Park.

12.4.16 The forecast traffic flow increases are considered not to result in a significant increase in congestion.

12.4.17 Utilities works (including diversions) have been assessed in detail only where they are major works and where the traffic and transport impacts from the works separately, or in combination with other works, are greater than other construction activities arising from such works within the area. Minor utilities works are expected to result in only localised traffic and pedestrian diversions that will be of short term duration. These are not expected to result in significant additional adverse effects.

[78] In assessing significant effects of traffic changes on congestion and delays, a major adverse effect occurs where traffic flows at a junction 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 at a junction 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 at a junction 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.

[79] 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 for access.

12.4.18 The effect on accident and safety risks will not be significant. On one road, the A38, where there are existing highway safety issues, the overall change in traffic flow will not be sufficient to raise additional safety concerns.

12.4.19 It is not expected that the construction of the Proposed Scheme will require any bus route diversions, as road closures are mostly overnight when bus services will not be operational. Construction of the Proposed Scheme is not expected to result in any loss of pedestrian access to public transport. There are no stations/interchanges that will be affected by the Proposed Scheme in this area.

12.4.20 There will be four minor adverse effects on journey ambience for non-motorised users of PRoW within this area. These are: Streethay Footpath 6, which will be partly closed during construction, Kings Bromley Footpath 0.392, where users will have to cross roads utilised by construction traffic; and Whittington Footpath 17 and Alrewas Footpath 44, where construction vehicles will operate alongside the footpaths.

12.4.21 Rail possessions will be required to make the connection between the Proposed Scheme and the WCML. These possessions will be planned to help limit any disruptions to passenger and freight services and are described in section 2.3. As the possessions will be for only limited duration, the effect on public transport delay is considered to be not significant. The possessions required on the South Staffordshire Line are not expected to affect passenger services. The South Staffordshire line and the WCML will be used for the movement of bulk earthworks to and/or from Streethay construction sidings. These train movements will use available train paths and will have no effect on existing services.

12.4.22 The effects of construction of the permanent works over the Trent and Mersey canal and the construction of temporary works over the Coventry canal will not be significant, as any stoppage of the waterway, if required, would only be overnight.

Cumulative effects

12.4.23 The assessment includes cumulative effects of planned development during construction by taking this into account within the background traffic growth.

12.4.24 The assessment also includes in-combination effects by taking into account traffic and transport impacts of works being undertaken in the neighbouring Drayton Bassett, Hints and Weeford area (CFA21). The assessment for this area has, therefore, included inbound construction traffic flows of 450 cars/LGV and 1500 HGV per day and outbound construction traffic flows of 400 cars/LGV and 1500 HGV per day.

Permanent effects

12.4.25 Any permanent effects of construction have been considered in the operations phase assessments for traffic and transport in Section 12.5. This is because the impacts and effects of the forecast increases in travel demand and the wider impacts and effects of the operations phase need to be considered together.

Other mitigation measures

12.4.26 The implementation of the CoCP (see Volume 5: Appendix CT-003-000/1) in combination with the construction workforce travel plan will, to some degree, mitigate the transport related effects during construction of the Proposed Scheme.

The reductions in effects arising from these travel plan measures have not been included in the assessment, which will mean the adverse effects may be over-stated.

12.4.27 Rail replacement services will be provided as necessary during rail possessions.

12.4.28 No further traffic and transport mitigation measures during construction of the Proposed Scheme are considered necessary, based on the outcomes of this assessment.

Summary of likely residual significant effects

12.4.29 The most intensive peak periods of construction will cause increases in traffic that will affect pedestrians, cyclists and equestrians crossing and using: the A38 between its junction with the A5 to the south of Lichfield and its junction with Wood End Lane at Hilliards Cross; Cappers Lane from its junction with Austin Cote Lane eastwards to just beyond Mill Farm; Broad Lane from its junction with Cappers Lane eastwards to just past the WCML; and Wood End Lane from its junction with the A38 at Hilliards Cross to the junction with Nanscawen Road in Fradley Park.

12.4.30 There will be four minor adverse effects on journey ambience for non-motorised users of PRoW within this area.

12.4.31 The significant effects that result from construction of the Proposed Scheme are shown in Map TR-03-107, Volume 5, Map Book Traffic and Transport.

12.5 Effects arising from operation

Avoidance and mitigation measures

12.5.1 The following measures have been included as part of the design of the Proposed Scheme and will avoid or reduce impacts on transport users:

- retaining the majority of roads crossing the Proposed Scheme in, or very close to, their current locations, resulting in no significant diversions of traffic onto alternative routes;
- retaining PRoW crossing the Proposed Scheme, with any realignments kept to a minimum where reasonably practicable; and
- modifications to the WCML to accommodate additional train movements.

Assessment of impacts and effects

12.5.2 The following section considers the impacts on traffic and transport and the consequential effects resulting from the operational phase of the Proposed Scheme (as described in Section 2.4 of this report).

12.5.3 The operational traffic and transport impacts within this area will include:

- permanent realignment of five roads;
- permanent closure of one road (part of Shaw Lane);
- permanent realignment of five PRoW, all footpaths; and
- traffic accessing the areas of the Proposed Scheme for maintenance purposes.

12.5.4 During the operation of Phase 1 of HS2, the number of train services on the WCML will be increased. Modification works to the WCML to accommodate these additional services are described in Volume 4. The effects of these additional services on the existing rail network are described in Volumes 3 and 4.

12.5.5 Part of Shaw Lane will be permanently closed, between the WCML bridge and the junction with Tuppenhurst Lane. The diversion of traffic from the east side of HS2, at Shaw Lane Farm, will be via the retained Shaw Lane to the A515 Lichfield Road and then B5014 Lichfield Road. The retained length of Shaw Lane will include passing places. The closure will cause increased journey times for road users, due to the 4.5km increase in distance, with a minor adverse effect. The length of Shaw Lane retained to the west of the WCML will become a short cul-de-sac.

12.5.6 There will be localised permanent realignments of five other roads – Darnford Lane, Broad Lane, the A5127 Burton Road northbound slip road onto the A38, Wood End Lane and Netherstowe Lane – with no significant effects.

12.5.7 Traffic flows are expected to be similar to those forecast without the Proposed Scheme in both 2026 and 2041. The only changes to traffic will be occasional traffic that may access areas of the Proposed Scheme for maintenance purposes. However, these vehicle movements are expected to be infrequent and will therefore have no significant effect.

12.5.8 The effect on accident and safety risks will not be significant as there are no substantial increases in traffic due to the operation of the Proposed Scheme.

12.5.9 The Proposed Scheme will have no effect on the four bus services that will be crossed by the alignment of the Proposed Scheme.

12.5.10 Five PRoW will be realigned within this area and two crossed without realignment. Of these, three will be increased in length by less than 100m and the effects will not be significant. The Proposed Scheme will have a minor adverse effect on two: Alrewas Footpath 31 (in Fradley Park) and Kings Bromley Footpath 0.392 (near Black Slough). The maximum increase in length will be approximately 490m (Kings Bromley Footpath 0.392). During surveys undertaken for this assessment no usage of this PRoW was recorded.

Cumulative effects

12.5.11 The assessment includes for the cumulative effects of planned development during operation, by taking this into account within the background traffic growth.

12.5.12 The assessment also considers in-combination effects by taking into account traffic and transport movements from other CFAs. However, there will be no in-combination impacts for this area.

Other mitigation measures

12.5.13 No further mitigation measures for the operation of the Proposed Scheme are considered necessary based on the outcomes of this assessment.

Summary of likely residual significant effects

12.5.14 Part of Shaw Lane will be closed and traffic will be diverted to other existing roads, which will cause increases in journey times for road users.

12.5.15 Two Footpaths (Alrewas 31 and Kings Bromley 0.392) will be realigned with increases in journey times for pedestrians.

12.5.16 The significant effects that will result from the Proposed Scheme are shown in Map TR-04-107 (Volume 5, Map Book, Traffic and Transport).

13 Water resources and flood risk

13.1 Introduction

13.1.1 This section provides a description of the current and future baseline for water resources including surface water, groundwater, and the baseline conditions for flood risk. It then reports on the likely impacts and significant effects on these aspects as a result of the construction and operation of the Proposed Scheme.

13.1.2 The main environmental features of relevance to water resources and flood risk that are present across the Whittington to Handsacre area (CFA22) include:

- Curborough Brook and Bourne Brook will be crossed by the Proposed Scheme and are classified as Main Rivers;
- Mare Brook, tributaries of the River Trent and tributaries of Mare Brook, a tributary of Fisherwick Brook and an un-named watercourse, which are ordinary watercourses, will be crossed by the Proposed Scheme;
- the Wyrley and Essington Canal and the Trent and Mersey Canal (artificial waterbodies) will be crossed by the Proposed Scheme;
- ponds north of Rough Stockings and at John's Gorse will be intersected by the Proposed Scheme;
- the Bromsgrove Sandstone Formation and Kidderminster Formation, which are classified as Principal aquifers, underlie much of the Proposed Scheme in the southern half of the Whittington to Handsacre area;
- a number of Secondary aquifers;
- numerous minor springs present within the study area; and
- five licensed groundwater abstractions present within the study area, two of which are used for public supply.

13.1.3 Key environmental issues relating to water resources and flood risk include:

- the need to realign part of a tributary of the Mare Brook near Wood End Lane, due to where the Proposed Scheme passes directly over the alignment of the existing watercourse for approximately 800 metres;
- the need to culvert and realign the Mare Brook and its tributaries at Streethay, Rough Stockings and Nanscawan Road (between Fradley South and Lichfield), and a tributary of the River Trent at Ashton Hayes, where they will be crossed by the Proposed Scheme;
- the need to culvert tributaries of the River Trent at White Gables, Handsacre and Lichfield Road;
- the Streethay construction sidings area where excavated materials will be stored and handled giving rise to a risk of pollution;
- the potential impact of changes in groundwater flow to issues, springs and on

groundwater dependent ecological receptors, such as in the vicinity of retaining walls; and

- the potential flood risk impact of the viaduct crossings over Bourne Brook, Curborough Brook, the Wyrley and Essington Canal and the Trent and Mersey Canal, as well as the potential works in floodplains.

13.1.4 Volume 5: Appendix WR-001-000 contains a report on the route-wide effects including:

- generic assessments on a route-wide basis;
- stakeholder engagement;
- in combination effects;
- a draft operation and maintenance plan for water resources and flood risk;
- a Water Framework Directive (WFD)[80] compliance assessment; and
- a route-wide Flood Risk Assessment (FRA).

13.1.5 Detailed reports on water resources and flood risk within the Whittington to Handsacre area are also contained in the Volume 5 appendices. These include:

- Appendix WR-002-022: Water Resources Assessment report;
- Appendix WR-003-022: Flood Risk Assessment; and
- Appendix WR-004-015: River Modelling Report.

13.1.6 Map series WR-01 to WR-03 and WR-05 to WR-06 showing details referred to in this report and those in Volume 5 are all contained in the Volume 5: Map Book – Water resources.

13.1.7 Discussions have been held with the Environment Agency, Staffordshire County Council (SCC) as the Lead Local Flood Authority (LLFA) and the Canal & River Trust (formerly British Waterways).

13.2 Scope, assumptions and limitations

13.2.1 The assessment scope, key assumptions and limitations for the water resources and flood risk assessment are set out in Volume 1, Section 8 and in the SMR and its addendum (Volume 5: Appendices CT-001-000/1 and CT-001-000/2) and appendices presented in Volume 5: WR-002-022 and WR-003-022. This report follows the standard assessment methodology.

13.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for

[80] Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, European Parliament and European Council, Strasbourg.

example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this is defined as the study area.

13.2.3 Due to the number of ponds and other water features present within the study area, only those either within the land required for the construction or operation of the Proposed Scheme, or within the calculated zone of influence have been detailed in the baseline in this assessment.

13.2.4 Water Framework Directive (WFD) classification data has been made available by the Environment Agency. For surface water bodies that do not have a WFD status class shown in the relevant River Basin Management Plan (RBMP), the status class has been taken as the status class for the first downstream water body for which a status class is reported. Where groundwater does not have a WFD status class shown in the relevant River Basin Management Plan (RBMP), these are referred to as 'not assessed by the Environment Agency' in the summary of geology and hydrogeology in Table 25.

13.2.5 Groundwater level data from the Environment Agency and other monitored locations such as private abstractions are limited in the study area. It is assumed that groundwater levels vary in a similar fashion to topography throughout the study area, with groundwater level contours roughly parallel to topographic contours. In the absence of more detailed information, it has been generally assumed that groundwater levels are within 1m of the ground surface.

13.2.6 The limitations associated with flood risk within this study area are described in detail in the Volume 5: Appendix WR-003-022.

13.3 Environmental baseline

Existing baseline surface water resources

Surface water features

13.3.1 All water bodies within the study area fall within the Humber River Basin District (RBD). The exception is the Coventry and Ashby Canals waterbody (which includes the Birmingham and Fazeley and Coventry canals) which is located within the Severn RBD as set out within the RBMP[81,82]. Apart from the Coventry and Ashby canals, all water bodies within the study area fall within the Tame Anker and Mease or the Staffordshire Trent Valley sub-catchment. Water courses within the study area include Bourne Brook, Curborough Brook, Pyford Brook and Mare Brook.

13.3.2 The current surface water baseline is shown in Volume 5: Maps WR-01-037 to WR-01-038 and all surface water features within the study area are assessed within Volume 5: Appendix WR-002-022. Table 24 includes features potentially affected by the Proposed Scheme.

[81] Environment Agency (2009), *River Basin Management Plan, Humber River Basin District.*
[82] Environment Agency (2009), *River Basin Management Plan, Severn River Basin District.*

Table 24: Surface water features potentially affected by the Proposed Scheme

Water feature	Location description (map reference[83])	Watercourse classification[84]	WFD water body name and number and current overall status	WFD status objective (by 2027* as per Humber River Basin Management Plan (RBMP), unless stated)	Receptor value[85]
Drain feeder to Fisherwick Brook	At Mill Farm (SWC-CFA22-001)	Ordinary watercourse	East Lichfield catchment – tributary of Tame (GB104028047020) – Moderate Status.	Good Status	Moderate
Wyrley and Essington Canal (under restoration)	At Canal Cottage Cappers Lane (SWC-CFA22-002)	artificial watercourse			Moderate
Tributary of Mare Brook	At Birch Wood – Streethay (SWC-CFA22-003)	Ordinary watercourse			Moderate
Mare Brook	At Rough Stockings – Streethay (SWC-CFA22-004)	Ordinary watercourse	River Tame from River Anker to River Trent (GB104028047050) – Poor Status	Good Status	Moderate
Pond	North of Rough Stockings (SWC-CFA22-005)	Not applicable			Refer to Ecology Volume 2, CFA22 Report, Section 7.
Tributary of Mare Brook	At Nanscawan Road – Hilliard's Cross (SWC-CFA22-006)	Ordinary watercourse	Pyford Brook Catchment – tributary of Trent (GB104028047250) – Moderate Potential	Good Potential	Moderate
Tributary of Mare Brook	At Wood End Lane – Hilliards Cross (SWC-CFA22-007)	Ordinary watercourse			Moderate
Pond	At Wood End Lock (SWC-CFA22-008)	Not applicable			Refer to Ecology Volume 2, CFA22 Report, Section 7.

[83] Refer to Appendix 5: Map Book – Water resources, maps WR-01-37 and WR-01-38

[84] Water-feature classifications: Section 113 of the Water Resources Act 1991 defines a main river as a watercourse that is shown as such on a main river map. Section 72 of the Land Drainage Act 1991 defines an ordinary watercourse as 'a watercourse that is not part of a main river'. Section 221 of the Water Resources Act 1991 defines a watercourse as including ' all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. Main rivers are larger rivers and streams designated by Defra on the main river map and are regulated by the Environment Agency.

[85] For examples of receptor value see Table 43 in the SMR.

Water feature	Location description (map reference[83])	Watercourse classification[84]	WFD water body name and number and current overall status	WFD status objective (by 2027* as per Humber River Basin Management Plan (RBMP), unless stated)	Receptor value[85]
Trent and Mersey Canal	At Fradley Wood (SWC-CFA22-009)	Artificial watercourse	Trent and Mersey Canal, summit to Alrewas (GB70410142) – Good Potential	Good Potential (by 2015)	Moderate
Curborough Brook	At Wood End Lock (SWC-CFA22-010)	Main river	Pyford Brook Catchment – tributary of Trent (GB104028047250) – Moderate Potential	Good Potential	High
Trent and Mersey Canal	At Wood End Lock (SWC-CFA22-011)	Artificial watercourse	Trent and Mersey Canal, summit to Alrewas (GB70410142) – Good Potential	Good Potential (by 2015)	Moderate
Bourne Brook	At John's Gorse (SWC-CFA22-012)	Ordinary watercourse	Bourne-Bilson Brook Catchment – tributary of Trent (GB104028047270) – Good Status	Good Status (by 2015)	High
Pond	John's Gorse (SWC-CFA22-013)	Not applicable			Refer to Ecology Volume 2, CFA22 Report, Section 7.
Drain	At Harvey's Rough/Shaw Lane Farm (SWC-CFA22-014)	Ordinary watercourse	River Trent from Moreton Brook to River Tame (GB104028047290) – Poor Potential	Good Potential	Moderate
Tributary of River Trent	At Harvey's Rough (SWC-CFA22-015)	Ordinary watercourse			Moderate
Tributary of River Trent	At Ashton Hayes (SWC-CFA22-016)	Ordinary watercourse			Moderate
Tributary of River Trent	At Lichfield Road (B5014) (SWC-CFA22-017)	Ordinary watercourse			Moderate
13 further ponds	Located within the land required for the construction and operation of the Proposed Scheme.	Not applicable			Low

Water Framework Directive status

13.3.3 The Environment Agency notes that the overall WFD classification of both the River Trent and River Tame is Poor Status. The overall WFD classification of the East Lichfield Catchment is Moderate Status and for the Pyford Brook it is Moderate Potential. The overall WFD classification of the Bourne-Bilson Brook is Good Status and the Trent and Mersey Canal is Good Potential. The WFD status/potential objective of all these water bodies is Good by 2027 and by 2015 for the Trent and Mersey Canal and Bourne-Bilson Brook.

13.3.4 The WFD status and objectives of water bodies that are not crossed by the route is shown in Volume 5: Appendix WR-002-022.

Abstractions and permitted discharges

13.3.5 There are 11 locations where surface water is abstracted within 1km of the Proposed Scheme in this study area, according to data from the Environment Agency[86] (details in Volume 5: Appendix WR-002-022).

13.3.6 Information from Lichfield District Council indicates that there are no unlicensed abstractions from surface water used for potable supply in their records.

13.3.7 There is potential for further unlicensed abstractions to exist as a licence is not required for abstractions volumes below 20 cubic metres per day.

13.3.8 Envirocheck data indicates that there are 68 current permitted surface water discharges within 1km of the Proposed Scheme in this study area (details in Volume 5: Appendix WR-002-022).

Existing baseline – groundwater resources

Geology and hydrogeology

13.3.9 The location of abstractions and geological formations are shown in Volume 5: Map WR-02-022.

13.3.10 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 25. Unless otherwise stated, the geological groups listed are all crossed by the route.

[86] Surface water abstractions for public supply are not included.

Table 25: Summary of geology and hydrogeology in CFA22

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value
Superficial deposits						
Glaciofluvial sheet deposits	Located around the northern part of the route and across the Manchester spur	Sand and Gravel	Secondary A aquifer	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Alluvium	Spatially limited deposits	Clay, silt, sand and gravel	Secondary A aquifer	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Undifferentiated deposits (Head)	Small (20ha) area north-west of Streethay	Clay, Silt, Sand and Gravel	Secondary (Undifferentiated)	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
River terrace deposits	Situated along Mare Brook and tributaries, between Lichfield and Fradley South	Sand and Gravel	Secondary A aquifer	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Bedrock						
Kidderminster Formation	Relatively small outcrop of Kidderminster Formation in the south of the study area	Conglomerates and sandstones	Principal aquifer	Tame Anker Mease – PT Sandstone Birmingham Lichfield (GB40401G301000) Poor Status	Poor Status	High
Bromsgrove Sandstone Formation	Underlies the southern extent of the study area	Sandstones, commonly pebbly or conglomeratic at the bases of beds, interbedded siltstones and mudstones	Principal aquifer	Tame Anker Mease – PT Sandstone Birmingham Lichfield (GB40401G301000) Poor Status	Poor Status	High
Mercia Mudstone Group	Underlies the northern half of the route in the study area	Mudstones and subordinate siltstones	Secondary B aquifer	Tame Anker Mease – Secondary Combined (GB40402G990800) Poor Status	Good Status	Moderate

* Year may vary in different RBMPs.

Superficial deposits

13.3.11 Superficial deposits are present intermittently along the Proposed Scheme, and it will pass through:

- Alluvium comprising clay, silt, sand and gravel, and river terrace deposits (sand and gravel) associated with major surface watercourses;
- Glaciofluvial sheet deposits (comprising sand and gravel with lenses of clay, silt and organic material), which underlie the Proposed Scheme almost continuously from Gorse Farm at Fradley to the northern end of the study area; and
- Head deposits, variably comprising clay, silt, sand and gravel, present to the north of Streethay.

13.3.12 Where present, alluvium, river terrace deposits and glacial river deposits are classified as Secondary A aquifers.

13.3.13 The groundwater vulnerability of the groundwater within the superficial deposits of the Secondary A and Secondary undifferentiated aquifers within the study area is high.

Bedrock aquifers

13.3.14 The Sherwood Sandstone Group comprises the Kidderminster Formation and the Bromsgrove Sandstone Formation and is classified as a Principal aquifer.

13.3.15 The Mercia Mudstone Group (Mudstone) is classified as a Secondary B aquifer.

13.3.16 Groundwater levels within the Principal and Secondary aquifers are unknown but are considered likely to be influenced by topography, in general, with flow towards rivers.

Water Framework Directive status

13.3.17 No WFD classification has been given by the Environment Agency to the superficial deposits.

13.3.18 The overall WFD status of groundwater in the areas where the Bromsgrove Sandstone Formation, Kidderminster Formation and Mercia Mudstone Group are present is currently poor status and is predicted to be of poor status for 2015.

13.3.19 The reason for the poor status is given in the RBMP for the Humber River Basin District, which states that: "The main reasons for Poor Status are high or rising nitrate concentrations with failures for pesticides and chemicals associated with mine working. The main reason for poor quantitative status is that abstraction levels, mainly for drinking water, exceed the rate at which aquifers recharge".

13.3.20 The groundwater underlying the Proposed Scheme is classified as at risk from the southern boundary of the study area to Fradley Junction. North of this point the groundwater is classified as probably at risk.

Abstractions and permitted discharges

13.3.21 The locations of licensed abstractions within the study area are shown in Volume 5: Appendix WR-002-022, Table 4. The locations are shown in Volume 5: Map WR-02-022.

13.3.22 The Environment Agency reports that there are five licensed groundwater abstractions within the study area, two of which are used for public supply (further details are provided in Volume 5: Appendix WR-002-022).

13.3.23 No unlicensed potable abstractions have been identified within the study area.

13.3.24 There is potential for further unlicensed abstractions to exist as a licence is not required for abstractions volumes below 20 cubic metres per day.

13.3.25 A groundwater Source Protection Zone 1 (SPZ1) is present in the vicinity of Lichfield Trent Valley Station and is surrounded by an SPZ2 (see Volume 5: MapWR-02-022). A groundwater Source Protection Zone 3 (SPZ3) is designated where the Kidderminster Formation and the Bromsgrove Sandstone Formation principal aquifers are present in the southern half of the study area.

13.3.26 The study area also encroaches on an SPZ1 and SPZ2 between Tewnals Lane and Hanch Farm to the south-east of Handsacre.

13.3.27 Envirocheck data indicates that there are 18 current permitted discharges to groundwater within the study area (further details are provided in Volume 5: Appendix WR-002-022).

Surface water/groundwater interaction

13.3.28 Surface water/groundwater interaction is widespread throughout the study area in the form of springs and issues (generally a less defined area of rising groundwater than a spring), ponds, sinks, and watercourses. Locations of these features are detailed in Volume 5: Appendix WR-002-022, Table 6.

13.3.29 Ponds which may potentially be affected by the Proposed Scheme, are summarised in Table 24 and listed in full in Table 6 of Volume 5: Appendix WR-002-022. These ponds are assumed to be in hydraulic connectivity with groundwater, unless further assessment suggests that the ponds are situated upon low permeability strata, or lined with an impermeable layer.

Water dependent habitats

13.3.30 There are no areas with statutory ecological designations in relation to surface water or groundwater in the study area.

13.3.31 There are a number of potentially water dependent ecological sites within 1km of the route in the Whittington to Handsacre area which are locally designated. These are detailed in Table 7 of Volume 5: Appendix WR-002-022 and include:

- Big Lyntus (ancient woodland);
- Tomhay Wood (ancient woodland);
- Whittington Heath Golf Course Site of Biological Importance (SBI); and

- Fradley Wood Biodiversity Action Site (BAS).

13.3.32 Further information on the above ecological receptors is given in Section 7.

Existing baseline – flood risk

River flooding

13.3.33 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping. This mapping has been supplemented with the use of site-specific hydraulic modelling at all locations where the Proposed Scheme will cross watercourses shown on OS mapping.

13.3.34 West of Whittington, the route is on a viaduct that crosses Cappers Lane, the Wyrley and Essington Canal and a tributary of the Fisherwick Brook. The catchment are draining to this location is approximately 15km^2. The course of the tributary has historically been altered to serve the Mill upstream of Cappers Lane. The watercourse is perched on the side of the valley above the floodplain. Flood flows will spill out of the watercourse into the valley below, rejoining the watercourse downstream of Cappers Lane. The width of the floodplain has been estimated to be up to 100m, however the viaduct structure will be 210m to allow it to span the watercourse, floodplain, canal and Cappers Lane. There are no residential properties within the floodplain near to Proposed Scheme, the land use within the floodplain is agricultural and therefore less vulnerable (moderate value receptor).

13.3.35 The Curborough Brook flows north from Lichfield and passes under the Trent and Mersey Canal north of Wood End Lane. The catchment area draining to this location is approximately 17km^2. The Environment Agency Flood Zone Mapping indicates that the floodplain is approximately 100m wide at the point where the route will cross the watercourse. However the hydraulic modelling completed as part of this assessment has shown that due the constrictions upstream of the crossing point as the Brook passes under the road and the canal, the flood extent is much narrower, approximately 15m. The viaduct structure spanning the Curborough Brook is 63m wide. In the vicinity of the Proposed Scheme, the only land use is agricultural, and therefore less vulnerable (moderate value receptor).

13.3.36 To the south east of where the route joins the WCML the route is on a viaduct across the Bourne Brook. The catchment are draining to this location is approximately 28km^2. The route will cross approximately 180m of Flood Zone 3. The Bourne Brook flows under the WCML approximately 300m upstream of the route. The land use within the floodplain in the vicinity of the Proposed Scheme is agricultural and therefore less vulnerable (moderate value receptor).

13.3.37 There are no residential properties within the modelled Flood Zone 3 within this CFA. For all the watercourses the land use has been identified as less vulnerable in the vicinity of the Proposed Scheme. The flood risk assessment in Volume 5: Appendix WR-003-022 provides further details of receptors within the flood zones and their vulnerability.

13.3.38 There are residential properties at Mill Farm on Cappers Lane within the Environment Agency Flood Zones 2 and 3 near to the Proposed Scheme. At the south of Handsacre there are a number of properties on Chestnut Close adjacent to a minor watercourse

and whilst they are not designated as within Flood Zone 2 or 3, because of their location, the watercourse has been assessed on the basis that it could affect more vulnerable properties. At the other watercourse crossings the land use has been identified as less vulnerable. The flood risk assessment in Volume 5: Appendix WR-003-022 provides further details of receptors within the flood zones and their vulnerability.

13.3.39 Historical flooding events have been taken from the Environment Agency mapping, the Lichfield SFRA[87] and the Staffordshire PFRA[88]. The Staffordshire PRFA reports that the Council have a record of historical flooding events near where the Proposed Scheme will cross Cappers Lane. These events have been classed as exceptional and did not affect any properties.

Surface water flooding

13.3.40 The agreed data set for surface water flooding is the Environment Agency's Flood Map for Surface Water (FMfSW), as shown on Volume 5: Maps WR-01-037 and 038.

13.3.41 These maps have been reviewed to form the basis of the assessment of the impact of the Proposed Scheme on the risk of surface water flooding.

13.3.42 The Flood Maps for Surface Water show two rainfall events, the 1 in 30 (3.3%) and the 1 in 200 (0.5%) annual probability events. The areas susceptible to surface water flooding during the 1 in 200 (0.5%) annual probability event are shown on Volume 5: Maps WR-01-037 and -038.The maps show areas currently at risk of surface water flooding and where surface water is generally collected in rural low points in topography such as following open drainage channel networks associated with the watercourses in the Whittington to Handsacre area.

13.3.43 Eight areas identified to be at risk of surface water flooding are classified to be at a high risk. The areas at risk of surface water flooding can be categorised into three types:

- areas associated with existing watercourses;
- overland flow paths; or
- isolated areas (e.g. low spots where water collects).

13.3.44 In this study area there are three locations where overland flow paths which do not follow a watercourse are evident on the FMfSW. These are located as follows:

- one to the north-east of Streethay (Volume 5: Map WR-01-037, C5); and
- two between the north of Wood End Farm and Vicar's Coppice (Volume 5: Map WR-01-038, E7 and F6).

13.3.45 Historical flooding events have been taken from the Lichfield SFRA and the Staffordshire PFRA. The Lichfield SFRA indicates that an undated event caused inundation 150m west of the route at Streethay, although the source of this flooding is

[87] Lichfield District Council (2008), *Lichfield Strategic Flood Risk Assessment*. Completed by Halcrow Group Ltd.
[88] Staffordshire County Council (2011), *Staffordshire Preliminary Flood Risk Assessment*. Completed by Royal Haskoning on behalf of Staffordshire County Council.

unknown, but given its location it is likely to be surface water or sewer flooding. The Staffordshire PRFA reports that the Council have a record of historical flooding events near where the Proposed Scheme will cross Cappers Lane. These events have been classed as exceptional but they have not affected any properties.

Sewer flooding

13.3.46 The agreed data sets for sewer flooding are the Lichfield SFRA[87], the Staffordshire PFRA[88]. In this location Severn Trent Water asset mapping has also been used.

13.3.47 The Proposed Scheme will be in the vicinity of the sewer network in five locations, and therefore there is the potential for flood risk from this source to be affected. At two of these locations, the topography of the area indicates that there are no flow paths from surcharge points to the Proposed Scheme. At three locations where the sewer network is located in close proximity to the Proposed Scheme, the potential for restricted flow paths have been identified. Therefore, it is concluded that there is a medium risk of flooding from the sewer network.

13.3.48 Historical events taken from the Lichfield SFRA and the Staffordshire PFRA indicate that there have been no incidents of sewer flooding either at the location of the route or within 1km of the route. The exception to which is the event that caused inundation 150m west of the route at Streethay (as reported in the Lichfield SFRA), although the source of this flooding is unknown, but given its location it is likely to be surface water or sewer flooding.

Artificial water bodies

13.3.49 The agreed dataset for reservoir flooding is the Environment Agency reservoir inundation mapping[89]. OS mapping has been used to determine the location of canals within the study area.

13.3.50 Flooding from artificial systems may occur from failure of a retaining structure that impounds water. The following man-made features have been identified within the FRA (Volume 5: Appendix WR-003-022) as being a potential source of flood risk:

- the canal system; and
- reservoirs.

13.3.51 There are two canals that are crossed by the route in this study area. These are the Wyrley and Essington Canal (Volume 5: Map WR-01-037, SWC-CFA22-002) and the Trent and Mersey Canal (Volume 5: Map WR-01-038, SWC-CFA22-009; SWC-CFA22-011), which are crossed by the Cappers Lane viaduct , Trent and Mersey Canal East and west viaducts and Trent and Mersey Canal viaduct for the Manchester spur respectively.

13.3.52 Topographic data indicates that the Trent and Mersey Canal (Volume 5: Map WR-01-038, SWC-CFA22-009; SWC-CFA22-011) is not raised above surrounding ground levels and hence there is no risk of structural breaching when the water level is maintained at the design level. However, the Wyrley and Essington Canal (Volume 5: Map WR-01-

[89] Environment Agency. What's in my backyard? Risk of Reservoir Flooding. http://maps.environment-agency.gov.uk/wiyby/wiybyController?x=357683.0&y=355134.0&scale=1&layerGroups=default&ep=map&textonly=off&lang=_e&topic=reservoir. Accessed September 2013.

037, SWC-CFA22-002) is raised above the surrounding ground level, but if breaching occurs, flood water will flow along the corridor of the watercourse at this location (Volume 5: Map WR-01-037, SWC-CFA22-001) and so will not adversely affect the surrounding area.

13.3.53 The canals will also be overtopped if water levels rise above the design level, however, water levels in canals are maintained and therefore it is unlikely that overtopping will occur. In addition, the Proposed Scheme will not increase the risk of flooding from this source. The risk from this source of flooding is low.

13.3.54 There are three water bodies that are listed in the Environment Agency Reservoir Inundation Flood Mapping as posing a flood risk to the Proposed Scheme. These reservoirs, Swinfen Lake, Stowe Pool and Minster Pool, pose a risk at two locations, described below. However, the data provided does not indicate flood depths, flow velocities or the time taken for onset of flooding after a breach takes place.

13.3.55 The route crosses a tributary of Fisherwick Brook, which is likely to act as a flow path for reservoir flooding from Swinfen Lake. The route also crosses Curborough Brook, which is likely to act as a flow path for reservoir flooding from Stowe Pool or Minster Pool. At both these locations the inundation extent covers a greater extent than the Flood Zone mapping.

13.3.56 Due to the strict regulations and high level of maintenance associated with reservoirs, breaching is considered very unlikely. In addition, the Proposed Scheme will not increase the risk of flooding from this source as no works that will affect the integrity of the impounding structures are proposed. Therefore, the risk from this source of flooding is categorised as low.

13.3.57 Historical events taken from the Lichfield SFRA and the Staffordshire PFRA indicate that there have been no incidents of reservoir or canal flooding either at the location of the route or within 1km of the route.

Groundwater flooding

13.3.58 The agreed datasets for groundwater flooding is the Staffordshire County Council PFRA and the Lichfield District Council SFRA

13.3.59 Lichfield District Council's SFRA and Staffordshire County Council's PFRA state that there have been no observed or recorded incidences of groundwater flooding.

13.3.60 There is reference within the PFRA guidance document to a risk of groundwater flooding from groundwater rebound within Lichfield.

Future baseline

13.3.61 Section 2.1 and Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme. The potential cumulative effects arising from committed developments in relation to water resources and flood risk have been considered as part of this assessment of the construction and operation of the Proposed Scheme.

Construction (2017)

13.3.62 All committed developments are required to comply with the National Planning Policy Framework (NPPF[90]), development plans and other legislation and guidance. As such committed developments are not expected to have a material effect on the water resources and flood risk baseline.

13.3.63 WFD future status objectives are set out in Table 24 and Table 25. This potential change in baseline is not considered to result in significant changes to the reported effects from the Proposed Scheme.

Operation (2026)

13.3.64 For the reasons stated above for construction, the cumulative development will not result in a change in significance of the effects from operation of the Proposed Scheme.

Climate change

13.3.65 Current projections to the 2080s indicate that climate change may affect the future baseline against which the impacts of the Proposed Scheme on surface water and groundwater resources have been assessed. There may be changes in the flow and water quality characteristics of surface water and groundwater bodies as a result of changes in climate. However, except for flood flows described in this section, these are not considered to result in the reported effects from the Proposed Scheme changing in significance.

13.3.66 Current projections indicate that there will be more frequent, higher intensity rainfall events in the future. The probability and severity of surface water flooding could therefore increase as surface water drainage systems fail to cope with more frequent, higher intensity storms. Peak river flows during flood events are expected to increase, potentially causing greater depths and extents of flooding.

13.3.67 When considering the influence that climate change may have on the future baseline, against which impacts from the Proposed Scheme on flood risk has been evaluated, the assessment has used the recommended precautionary sensitivity ranges of key parameters, as given in Table 5 in the Technical Guidance to the NPPF. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.

13.3.68 Further information on the potential additional impacts of climate change for water resources and flood risk is provided in Sections 7 and 8 of Volume 1 and Table 13 of Volume 5: Appendix CT-009-000.

13.4 Effects arising during construction

Avoidance and mitigation measures

13.4.1 The general approach to mitigation is set out in Volume 1.

[90] Department for Communities and Local Government (2012), *National Planning Policy Framework*.

13.4.2 The following measures will reduce potentially significant adverse effects on water resources and flood risk to levels that will not be significant. Further details are shown in Volume 5: Appendices WR-002-022 and WR-003-022.

13.4.3 Railway drainage will be managed using sustainable drainage techniques. In the study area surface water discharges are proposed to:

- a drain feeder to Fisherwick Brook at Mill Farm (Volume 5: Map WR-01-037, SWC-CFA22-001);
- Wyrley and Essington Canal at Canal Cottage Cappers Lane (Volume 5: Map WR-01-037, SWC-CFA22-002);
- tributaries of Mare Brook at Birch Wood, Nanscawan Road and Wood End Lane (Volume 5: Map WR-01-037, SWC-CFA22-003, 006 and 007);
- Trent and Mersey Canal at Fradley Wood and Wood End Lock (Volume 5: Map WR-01-038, SWC-CFA22-009 and 011);
- Curborough Brook at Wood End Lock (Volume 5: Map WR-01-038, SWC-CFA22-010);
- Bourne Brook at John's Gorse (Volume 5: Map WR-01-038, SWC-CFA22-012);
- a tributary of the River Trent at White Gables (Volume 5: Map WR-01-038, SWC-CFA22-018); and
- an unnamed drain at Black Slough (Volume 5: Maps WR-01-037 to WR-01-038).

13.4.4 Railway run-off will be attenuated with balancing ponds and restricted prior to discharge to emulate the existing environment by reducing run-off to existing greenfield rates where reasonably practicable.

13.4.5 It is proposed to culvert watercourses in seven places:

- a section of Mare Brook at Rough Stockings (Volume 5: Map WR-01-037, SWC-CFA22-004);
- sections of Mare Brook tributaries at Birch Wood, Nanscawan Road and Wood End Lane (Volume 5: Map WR-01-037, SWC-CFA22-003, 006 and 007); and
- sections of River Trent tributaries at Ashton Hayes, Lichfield Road and White Gables (Volume 5: Map WR-01-038, SWC-CFA22-016, 017 and 018).

13.4.6 Culvert length will be minimised wherever possible and will be designed with invert levels below the firm bed of the watercourse to negate the impact on flows and sediment transfer. Where possible, consideration will be given to provide mitigation for the loss of open channel by means of sensitive design at either end of the culvert in order to retain and, if possible, enhance the overall quality of the watercourse. Where there is loss of length due to straightening, the aim, where possible, will be to offset this by increasing channel length up or downstream of the culvert to at least match the lost length of channel. Culverts will be designed in line with Construction Industry

Research and Information Association (CIRIA)[91] and Environment Agency guidance and in consultation with the Environment Agency. The mitigation specifically for the ecology of the watercourses is considered in Section 7, Ecology.

13.4.7 Realignments are proposed along sections of the following watercourses:

- Mare Brook at Rough Stockings (Volume 5: Map WR-01-037, reference SWC-CFA22-004); and
- tributaries of Mare Brook at Birch Wood, Nanscawan Road and Wood End Lane (Volume 5: Map WR-01-037, references SWC-CFA22-003, 006 and 007).

13.4.8 The realignment of the section of a tributary of Mare Brook near Wood End Lane (Volume 5: Map WR-01-037, reference SWC-CFA22-007) is necessary because the Proposed Scheme directly follows the alignment of the existing watercourse for approximately 800 metres (see Volume 5: Maps WR-01-037 to WR-01-038). The other realignments are associated with culverts and landscaping for the Proposed Scheme. Consideration will be given to the detailed design to the objectives of the WFD as described in the RBMP. This may include the use of soft engineering solutions for bank design, and the inclusion of natural forms such as berms or incorporation of a two-stage channel, riffles and pools and marginal planting, where reasonably practicable.

13.4.9 Road realignments are required as part of the Proposed Scheme in this area (Wood End Lane, Darnford Lane). The watercourses receiving road run-off are as follows:

- a tributary of Mare Brook at Wood End Lane – Hilliard's Cross (Volume 5: Map WR-01-037, SWC-CFA22-007) to which it is assumed Wood End Lane outfalls; and
- a drain feeder to Fisherwick Brook at Mill Farm (Volume 5: Map WR-01-037, SWC-CFA22-001) to which it is assumed Darnford Lane outfalls.

13.4.10 Appropriate sustainable drainage mitigation will be provided for minor roads to address the risks to the receiving watercourses (for both flow and water quality) and will be selected using the Design Manual for Roads and Bridges (particularly HA103)[92] and CIRIA[93] guidance. For the major roads, (identified through the application of the SMR), detailed assessments will be made using the guidance from the Design Manual for Roads and Bridges through the detailed design phase. Initial assessments using the Highways Agency Water Risk Assessment Tool (HAWRAT) are shown in Volume 5, Appendix WR-002-022.

13.4.11 The level of the route has been raised in the vicinity of Swinfen Hall which has reduced the potential dewatering impact to Whittington Heath Golf Club (designated SBI).

13.4.12 The inclusion of a culvert beneath the route (Handsacre East culvert) has reduced the potential impact to Tuppenhurst Lane Local Wildlife Site (LWS). This will allow water from the issues (a form of spring) to the western side of the route to continue to feed into the receptor. Where the Proposed Scheme will interrupt surface water flow paths,

[91] Construction Industry Research and Information Association (2010), *C689 Culvert Design and Operation Guide.*
[92] DMRB. Volume 4 Section 2.
[93] CIRIA (2006), *c648 Control of water pollution from linear construction projects*.

the proposed drainage will be designed to intercept and manage this water. This will be achieved through collecting water in the proposed drainage and/or balancing pond prior to being discharged to the associated watercourse. This will allow the water to follow similar path to the existing situation.

13.4.13 Sustainable drainage systems (SuDS) and infiltration trenches will be implemented to facilitate recharge to the groundwater to help maintain groundwater levels within the Principal and Secondary aquifers. SuDS will also reduce the risk of potential contamination from accidental leaks or polluted surface water runoff from reaching the groundwater and, therefore, prevent deterioration in groundwater quality status. These SuDS and infiltration trenches will be located in areas where gravity transfer is achievable.

13.4.14 Replacement floodplain storage areas will be provided to mitigate the impact of the Proposed Scheme on river flood risk in consultation with the Environment Agency. At the Fulfen Wood culvert, replacement floodplain storage has been identified.

13.4.15 Section 16 of the draft Code of Construction Practice (CoCP) sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme (see Volume 5: Appendix CT-003-000/1). These will provide effective management and control of the impacts during the construction period.

13.4.16 The following measures in the draft CoCP Section 16 will reduce potentially significant adverse effects on water resources and flood risk to levels that will not be significant:

- stationary plant will be used with secondary containment measures such as plant nappies to retain any leakage of oil or fuel and reduce the risk of surface water or groundwater pollution;
- spill kits will also be provided where appropriate such as: Cappers Lane main compound, A515 Lichfield Road main compound, Handsacre (A515) main compound (rail systems), all satellite compounds and at Cappers Lane auto-transformer station, Lyntus auto-transformer station, Mare Brook package sub-station, to reduce the risk of surface water or groundwater pollution particularly in vulnerable areas such as SPZ1 (Volume 2: CFA22 Map Book, Map CT-10);
- the use of oil interceptors, if required, at site offices and work compounds; and
- appropriate measures such as use of bunds of non-erodible material or silt or sediment fences adjacent to watercourses such as Curborough Brook.

13.4.17 Measures defined in the draft CoCP Section 16, including detailed method statements, will ensure that there will be no effect on surface water quality or flows associated with construction; this will include release to surface waters sewers in the surrounding receptors, principally the Severn Trent Water sewer network.

13.4.18 In accordance with the draft CoCP, Section 16, monitoring will be undertaken in consultation with the Environment Agency prior to, during and post construction, if required, to establish baseline conditions for surface water and groundwater and to confirm the effectiveness of agreed temporary and permanent mitigation measures.

Assessment of impacts and effects

13.4.19 This section describes the significant effects following the implementation of avoidance and mitigation measures.

13.4.20 Further details of the potential impacts that will not have significant effects are provided in the Water Resources Assessment report in Volume 5: Appendix WR-002-022 and FRA in Volume 5: Appendix WR-003-022.

13.4.21 An assessment of the impact on the WFD status is detailed within the WFD Compliance Assessment, contained within the route-wide Water Resources Appendix (Volume 5: Appendix WR-001-000).

13.4.22 It is not considered that projected climate change effects, combined with the effects from the construction of the Proposed Scheme, will alter the significance of any of the reported effects on surface water and groundwater resources (see Volume 3: Route-wide Effects Assessment for further information).

Temporary effects

Surface water

13.4.23 The assessment shows there will be no significant temporary adverse effects on surface water resources during the construction period.

13.4.24 As no significant effects on surface water features have been identified in the assessment, no significant adverse effects on abstractions or discharges will arise.

Groundwater

13.4.25 The assessment shows that there will be no significant temporary adverse effects on groundwater, on licensed abstractions and permitted discharges , or on surface water/groundwater interaction, or on water dependent habitats.

Flood risk

13.4.26 The assessment has identified no significant increase in risks resulting from all sources of flood risk during the construction process and therefore no significant temporary effects will arise.

Cumulative effects

13.4.27 No committed developments have been identified that will result in significant cumulative effects.

Permanent effects

Surface water

13.4.28 The assessment shows that there will be no permanent significant effects on surface water features from the Proposed Scheme in the construction period.

13.4.29 Further details of the assessment, including the determination of the potential impacts that will not have significant effects are provided in Volume 5: Appendix WR-002-022.

Groundwater

13.4.30 The assessment shows that there will be no likely significant effects on groundwater, to abstractions, and permitted discharges , to surface water/groundwater interaction, or on water-dependent habitats.

Flood Risk

13.4.31 The assessment shows that there will be no likely permanent adverse significant effects on flood risk as a result of the Proposed Scheme.

13.4.32 Further details of the assessment, including the determination of the potential impacts that will not have significant effects are provided in Volume 5: Appendix WR-003-022.

Cumulative effects

13.4.33 There are no committed developments that have been identified that will result in significant cumulative permanent effects.

Other mitigation measures

13.4.34 No other mitigation measures are envisaged for surface water, groundwater or flooding.

Summary of likely residual significant effects

13.4.35 The assessment shows that there will be no residual significant effects on surface water, groundwater or flood risk during the construction period.

13.5 Effects arising from operation

Avoidance and mitigation measures

13.5.1 Generic examples of design measures that will mitigate potentially significant effects on the quality and flow characteristics of surface watercourses and groundwater bodies during operation and management of the Proposed Scheme, are described in Volume 1.

13.5.2 The sustainable drainage systems used for drainage from the Proposed Scheme such as balancing ponds may have an additional benefit of providing some treatment for water quality of the runoff before it is discharged into the environment.

13.5.3 Generic examples of management measures during operation and management of the Proposed Scheme that will reduce potentially significant adverse effects on the quality and flow characteristics of surface water courses and groundwater bodies are described in Volume 1 and in the draft operation and maintenance plan for water resources and flood risk included in Volume 5 Appendix WR-001-000.

13.5.4 Operation and management of the Proposed Scheme is not likely to have a significant effect on the flood risk anywhere in the catchments through which it passes. Generic examples of management measures that will reduce flood risk are described in Volume 1.

Assessment of impacts and effects

13.5.5 There are considered to be no significant adverse effects to surface water, groundwater or flood risk arising from operation of the Proposed Scheme.

Other mitigation measures

13.5.6 There are considered to be no further measures required to mitigate adverse effects on surface water resources, groundwater resources or flood risk.

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