LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA24 | Birmingham Interchange and Chelmsley Wood

November 2013

VOL 2

ES 3.2.1.24

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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 an assessment of local environmental effects;
- 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

1.1.1 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, high speed trains will connect with and run on the existing West Coast Main Line (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 2023/2024, 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 Two operational frequency has been used. For further detail of the anticipated operation of the Proposed Scheme in the Birmingham Interchange and Chelmsley Wood area (CFA24), see Section 2.4.

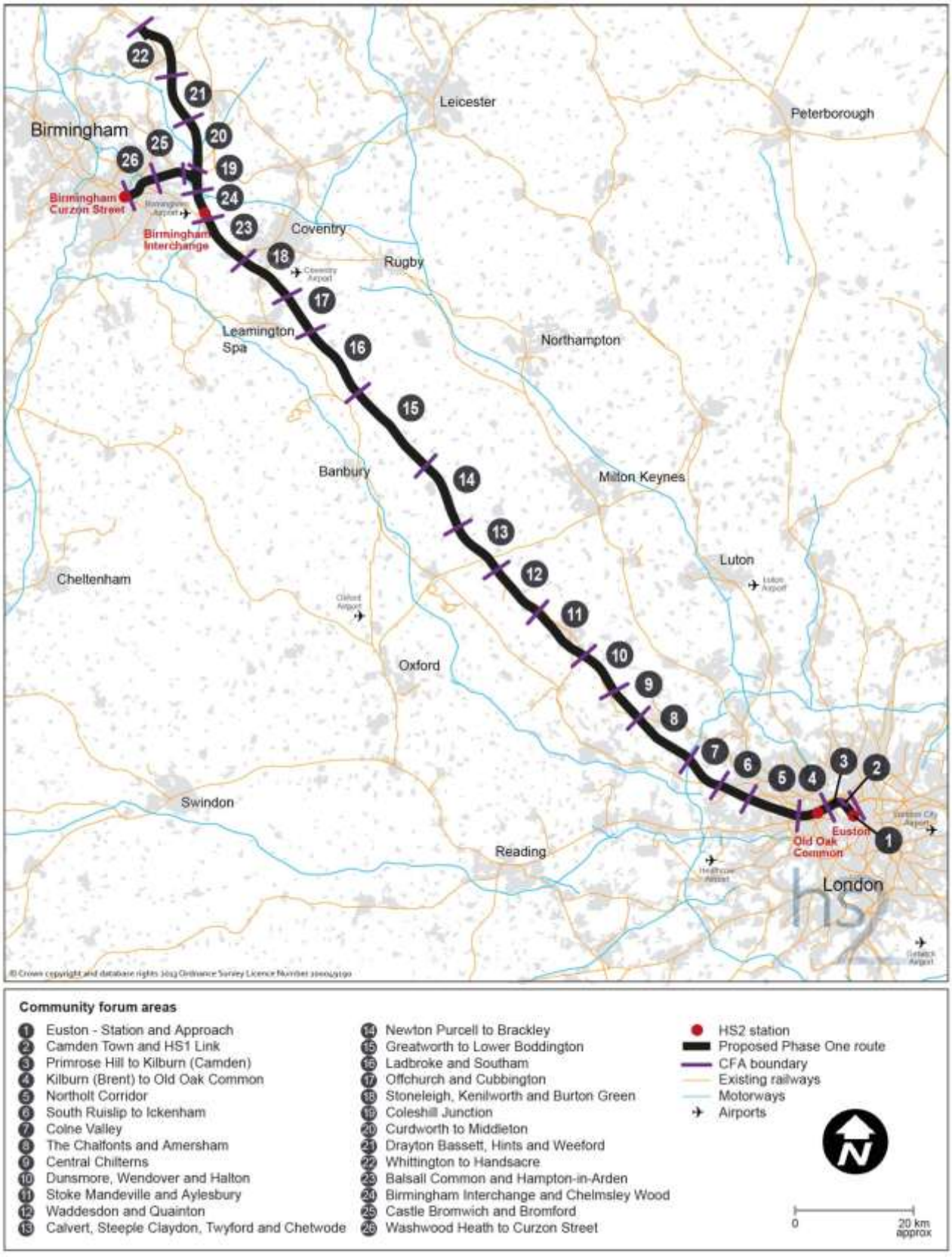
1.1.6 The Government believes that the HS2 network should link to Heathrow and its preferred option is for this to be built as part of Phase Two. However, the Government has since taken the decision to pause work on the Heathrow link until after 2015 when it expects the Airports Commission to publish 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 scheme design and on the likely adverse and beneficial effects.

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 with CFA24 (Birmingham Interchange and Chelmsley Wood). 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 CFA24.

Figure 1: HS2 Phase One route and community forum areas



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 assessment (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 the SMR Addendum also include additional information about climate change adaptation and resilience.

1.3.5 The maps relevant to Birmingham Interchange and Chelmsley Wood are provided in a separate corresponding document entitled Volume 2: CFA24 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 CT-05 (construction) (Volume2, CFA24 Map Book) and CT-06 (operation) (Volume 2, CFA24 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 CFA 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 Birmingham Interchange and Chelmsley Wood CFA covers approximately a 4.35km section of the Proposed Scheme in Solihull Metropolitan Borough, see Figure 2. It extends from south-east of the A45 Coventry Road, Hampton-in-Arden, at its southern boundary, to the administrative boundary between Solihull Metropolitan Borough Council (SMBC) and North Warwickshire Borough Council (NWBC), in close proximity to where the M42 intersects with the M6, at its northern boundary. The area includes land within the parish of Chelmsley Wood and parts of the Bickenhill, Hampton-in-Arden and Little Packington parishes.

2.1.2 Balsall Common and Hampton-in-Arden (CFA23) lies to the south and Coleshill Junction (CFA19) lies to the north.

The case for Birmingham Interchange

Policy case

2.1.3 The case for HS2, with a station at Birmingham Interchange, is well established within the national and regional policy context.

2.1.4 The Department for Transport's publication 'High Speed Rail: Investing in Britain's Future'[1] confirmed the choice of Birmingham Interchange station as an appropriate location, close to Birmingham Airport, Birmingham International station (Rugby to Birmingham line), as well as the M6 and M42, best serving passenger requirements including onwards travel.

2.1.5 At Birmingham Interchange, passengers will be able to transfer to the Rugby to Birmingham line and other local public transport. A people mover[2] which will be connected to the Birmingham Interchange station will provide a direct link to the NEC complex, Birmingham International station and Birmingham Airport.

2.1.6 Key local policies are set out within the Solihull Unitary Development Plan (SUDP) 2006[3], and the Solihull Draft Local Plan (SDLP) 2012[4]. The SUDP seeks to integrate transport with development across the Solihull area, aiming to promote sustainable transport choices. As part of this strategy, the SUDP seeks to encourage proposals for interchanges at key locations across Solihull Metropolitan Borough and in a wider sense across the West Midlands Region, to support an improved local and national transport network.

[1] Department for Transport (2012), *High Speed Rail: Investing in Britain's Future – Decisions and Next Steps.* London, Her Majesty's Stationery Office.
[2] The people mover is a system of transporting people rapidly between Birmingham Interchange station, the NEC, Birmingham International station and Birmingham Airport.
[3] Solihull Metropolitan Borough Council (2006), *Solihull Unitary Development Plan 2006.* SMBC, Solihull.
[4] Solihull Metropolitan Borough Council (2012), *Solihull Draft Local Plan 2012.* SMBC, Solihull.

2.1.7 The SDLP recognises that HS2 will play a key role in the future of Solihull Metropolitan Borough and the proposed route is broadly identified within the Spatial Strategy Diagram in the SDLP.

2.1.8 As defined by the SUDP, the Birmingham Interchange station is located in an area that is allocated as Green Belt. It is proposed that this designation (without amendment to the boundary) be carried forward within the SDLP. The SDLP identifies the area in and around the proposed Birmingham Interchange station as a mineral safeguarding area (MSA). Policy P13 seeks to permit the search for minerals and prevent alternative development that would permanently sterilise the mineral resource.

2.1.9 In June 2013 SMBC published the M42 Economic Gateway Masterplan (UK Central Masterplan)[5] which looks at various sites, including opportunities for new commercial development on the land around the proposed Birmingham Interchange station. While those plans are still being developed, HS2 Ltd will continue to work closely with SMBC and other stakeholders including Network Rail and landowners, to explore the potential for new opportunities above and adjacent to the station that could arise from or be facilitated by the Proposed Scheme, and which are also outlined in the above mentioned masterplan. Land around the station that would be required only for the construction phase may become available for appropriate development.

Transport planning case

2.1.10 Transport modelling has demonstrated that the majority of the passengers travelling to and from the West Midlands on HS2 will wish to travel to and from the central Birmingham terminus at Curzon Street station. However, there is a significant demand at Birmingham Interchange station to access locations to the south and east of Birmingham, such as Solihull, Leamington Spa, Warwick and Coventry.

2.1.11 Birmingham Interchange station will also offer the opportunity for passengers to interchange to the classic rail service via the link to Birmingham International station. At this station, passengers can access services on the Birmingham to Rugby line. The demand forecasts show that around 20% of HS2 passengers will use Birmingham Interchange to change onto the existing classic rail network, rather than interchanging in central Birmingham. This will reduce the number of passengers interchanging within the city centre, given potential journey time savings by connecting between Birmingham Interchange and Birmingham International stations.

2.1.12 The West Midlands Local Transport Plan 2011–2026 (WMLTP)[6] sets out a way forward to deliver the transport needs of the West Midlands Metropolitan Area through short, medium and long-term transport solutions[7]. The WMLTP is supportive of HS2 and seeks to actively promote HS2 with the aim of providing the metropolitan area with high-capacity, fast and reliable connectivity across the UK. The WMLTP sees this connectivity as providing major economic benefits to the region by allowing people to live and work in a greater range of places across the high speed rail network within the

[5] Solihull Metropolitan Borough Council (2013), *M42 Economic Gateway Masterplan Report. SMBC,* Solihull.
[6] Centro (2011), *West Midlands Local Transport Plan 2011-2026.*
[7] Centro (2011), *West Midlands Local Transport Plan, Local Transport Strategy Appendices 2011-2026.*

journey to work area, increasing their access to employment opportunities. The WMLTP identifies as a priority for action HS2 with stations at Birmingham Airport and Birmingham City Centre.

2.1.13 HS2 therefore has an important role in delivering the WMLTP strategic objectives towards supporting economic growth, reducing carbon emissions and reducing road congestion.

2.1.14 Centro's[8] draft prospectus 'Towards a World Class Integrated Transport Network'[9] sets out Centro's vision for public transport infrastructure in the region. The prospectus states: "It is essential that the West Midlands is connected to the European High Speed Rail Network. An international link to Birmingham Interchange and Birmingham City Centre HS2 stations will improve economic performance by increasing European connectivity and providing additional national rail capacity".

Settlement, land use and topography

2.1.15 The route passes through predominantly agricultural land (the majority of which lies within the Packington Estate and the Coleshill Estate) and urban areas, see Maps CT-06-105b to CT-06-107-R1 (Volume 2, CFA 24 Map Book). The urban areas relate to Chelmsley Wood, a large residential estate, and parts of the Birmingham Interchange area. The area around the proposed Birmingham Interchange station is predominately agricultural, whilst the area around Birmingham International station and Birmingham Airport is urban and predominantly an area of employment. Other key areas of employment include: the National Exhibition Centre (NEC) complex; Birmingham Business Park and the Packington Landfill site. The small historic settlements of Middle Bickenhill and Bickenhill are located within the Birmingham Interchange area.

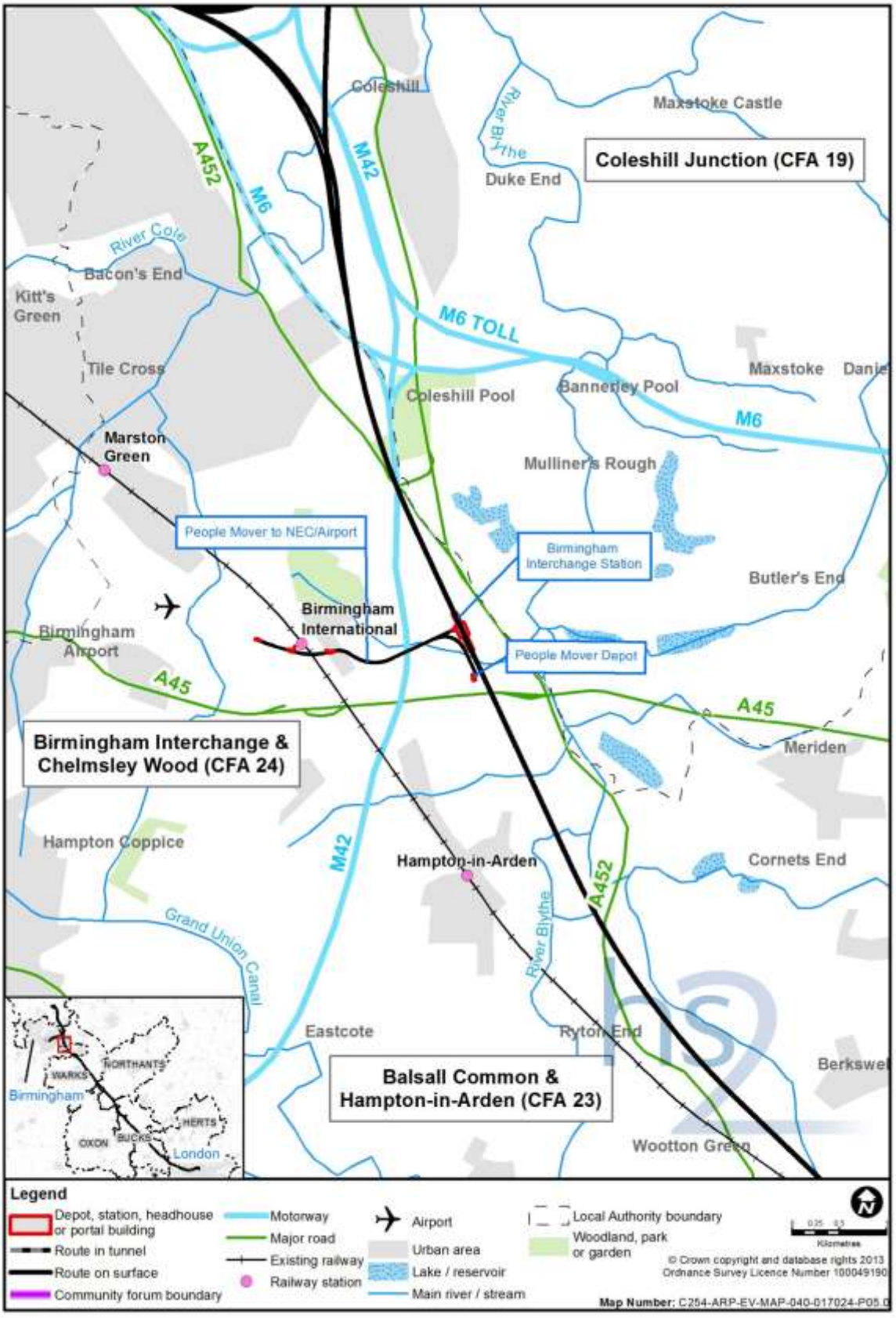
2.1.16 The topography of the area is dominated by the floodplains of the Rivers Blythe and Cole and related minor tributaries, which are associated with land generally below 80m above Ordnance Datum (AOD). The route passes through an area of gently sloping land, with slightly higher ground to the west of the River Blythe with the highest points in the vicinity of Diddington Hill and the A45 Coventry Road in the south. The shallow valley of Hollywell Brook is located to the north of the A45 Coventry Road. Lower land in the north is associated with the River Cole. Natural slopes are typically in the gradient range of 1:40 to 1:60.

2.1.17 There are two designated Sites of Special Scientific Interest (SSSI) within the study area, these are the channel of the River Blythe SSSI and Coleshill and Bannerly Pools SSSI. The channel of the River Blythe SSSI flows on the eastern side of Stonebridge Island. The SSSI is a fine example of a lowland river with a wide range of natural structural features that is rare in lowland England. The River Blythe SSSI supports diverse assemblages of aquatic plants and macro-invertebrate communities. Coleshill and Bannerly Pools SSSI is located between the route and the A446 Stonebridge Road. The SSSI is notified for its valley mire, wet woodland and the species they support, particularly plants that are scarce or have a localised distribution within the Midlands.

[8] Centro is the West Midland Passenger Transport Executive and Authority.
[9] Centro (2012); *Towards a World Class Integrated Transport Network Public Consultation Draft December 2012 – February 2013*.

2.1.18 Woodland areas are present, comprising both ancient and semi-natural woodland and secondary 20th century planted woodlands. Notable locations of woodland include: the Disused Track and Siding Wood Ecosite; Denbigh Spinney Local Wildlife Site (LWS); Pendigo Lake and The Rough Ecosite; and Coleshill Pool Wood LWS (see Maps CT-10-053, F4 and E6; CT-10-053-L1, F1; and CT-10-054a, H6, Volume 2, CFA24 Map Book).

Figure 2: Area context map



Key transport infrastructure

2.1.19 The existing Rugby to Birmingham line runs through this section of the Proposed Scheme to Birmingham International station, continuing in a north-west direction

towards Birmingham New Street station. Principal roads include: the A452 Chester Road; the A45 Coventry Road; the A446 Stonebridge Road, the M42, M6 and Coleshill Heath Road. Birmingham Airport is located within the Birmingham Interchange area.

Socio-economic profile

2.1.20 To provide a socio-economic context for the area, data is presented for the demographic character areas (DCA) of Birmingham Interchange and Chelmsley Wood[10]. In total, the population of Birmingham Interchange and Chelmsley Wood area is approximately 4,400; of which Birmingham Interchange DCA is approximately 1,400 and Chelmsley Wood DCA is approximately 3,000, which highlights the rural and urban fringe nature of the area. In 2011, unemployment in SMBC was 7% which was lower than the West Midlands (9%) and the same as the average for England (7%). The unemployment rate in the Birmingham Interchange DCA was 4%, with 15% recorded for the Chelmsley Wood DCA[11].

Notable community facilities

2.1.21 Local communities within the Birmingham Interchange area relate principally to the Parish of Bickenhill that lies across the A45 Coventry Road comprising the villages of Bickenhill, Middle Bickenhill and Marston Green. The settlements within the Bickenhill area retain a rural character with neighbourhood facilities at Marston Green including a public house called the Marston Green Tavern, a post office, Marston Green Infants and Junior primary school and two churches, St. Leonard's Church of England and Marston Green Baptist Church. The area is intersected by a cluster of major facilities with national significance, including: Birmingham Airport, Birmingham International station, the NEC and the National Motorcycle Museum.

2.1.22 Chelmsley Wood is a large residential estate located approximately 20km to the east of Birmingham. Chelmsley Wood includes a range of community facilities that mostly serve local residents. Located centrally within the estate is a range of facilities including: a library; police station; job centre; bank; a large food store and other shops. In addition, there is a neighbourhood centre at Craig Croft to the east of the estate, which provides a number of facilities including: a medical centre; family support services; St. Andrew's Church and Chelmsley Wood Baptist Church. There are three primary schools within the estate: the Windy Arbor Junior and Infant School to the eastern extent of the estate, Coleshill Church of England Primary School, and the Bishop Wilson Primary School, which has been relocated within the Craig Croft local centre. There are a number of public houses within the area including: Toby Carvery public house and restaurant and the Little Owl public house and restaurant.

2.1.23 Coleshill is a small town with a good range of day-to-day services and facilities, providing a choice of convenience stores, leisure, recreation, healthcare, residential care and schooling for all ages from pre-school to secondary. The town also has a range of employment opportunities, including at Hams Hall Industrial Estate to the north, which is a regionally important focus for business. Effects on Coleshill are discussed in Volume 2, CFA Report 19, Coleshill Junction (CFA 19), Sections 3 to 13.

[10] A DCA represents a community that, depending on the area, may consist of a local ward, neighbourhood or village(s).
[11] All statistics come from Office for National Statistics (ONS) (2012), *Census. 2011* ONS.

Recreation, leisure and open space

2.1.24 There are a limited number of public rights of way (PRoW) in the area. The most notable PRoW is located in close proximity to Melbicks Garden and Leisure centre, connecting the A452 Chester Road and the A446 Stonebridge Road, and a short section close to Diddington Farm, connecting a track with the A45 Coventry Road. Green Lane (located in Coleshill Junction (CFA19)) provides the main east-west route between Coleshill and Chelmsley Wood.

2.1.25 The Olympia Motorcycle Track is located to the north of Middle Bickenhill.

2.1.26 Public open space in the area is mostly in and around the Chelmsley Wood estate with the Bluebell Recreation Ground that borders the M6, on the outskirts of Chelmsley Wood. This recreation ground provides a range of facilities including a multi-use games area, a skate park, grassed football pitches, a children's play area and a community garden. Further to the north, Heath Park provides grassed football pitches and amenity parkland.

2.1.27 The neighbouring Coleshill has a good range of open spaces, the largest of which are Cole End Park, in the north of the town, and Coleshill Memorial Park, in the town centre, which provides sports pitches, tennis courts, a cricket pitch, a skate park and a children's play area. There are outdoor sports facilities at the schools, a bowling green to the rear of the High Street, a public playing field adjacent to the community centre and a network of amenity green spaces and corridors throughout the settlement.

Planning context

Planning framework

2.1.28 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, aside from those referred to in the previous section. 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.

2.1.29 The following local policies have been considered and referred to where appropriate to the assessment. Where a policy document is not referred to within a particular technical section, it is due to the absence of policies of relevance to that topic:

- SUDP (2006) is the current adopted development plan for the SMBC administrative area;
- SDLP (2012) has reached submission stage and is currently subject to examination by the Secretary of State. Once this plan has been adopted, the policies within it will replace those within the SUDP;
- North Warwickshire Local Plan (NWLP) (2006)[12] is the current adopted development plan for the NWCC administrative area. This will be replaced by

[12] North Warwickshire Borough Council (2006), *North Warwickshire Local Plan 2006.* (submitted version). NWBC

the emerging Core Strategy[13] which has reached submission stage and the examination by the Secretary of State is due to commence in January 2014;

- Minerals Local Plan for Warwickshire County Council (1995)[14] is the current Minerals Plan for the WCC administrative area. This will be replaced by the emerging Minerals Core Strategy[15] which is currently pre-examination at draft stage; and
- Warwickshire Waste Core Strategy (2013)[16] is the current adopted waste development plan for the WCC administrative area.

2.1.30 There are a number of key planning designations in the area, which include: conservation areas, listed buildings, scheduled monuments, important archaeological sites, historic parks and gardens, areas of ancient woodland, MSA and two SSSIs. These are shown on Maps CT-10-053 to CT-10-054a (Volume 2, CFA24 Map Book) and LQ-01-53 to LQ-01-054a (Volume 5, Map Book Land quality).

2.1.31 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 for the North Warwickshire Local Plan Core Strategy (2012) and the SDLP (2012).

Committed development

2.1.32 Developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme, are shown on Maps CT-13-053 to 054a-L1 (Volume 2, CFA24 Map Book) and listed in Section 1 of Volume 5: Appendix CT-004-000. Except where noted otherwise in Section 1 of Volume 5: Appendix CT-004-000, it has been assumed that these developments will have been completed by 2017. These are termed 'committed developments' and have been taken into account for the purpose of assessing the likely significant environmental effects of 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 topics assessments in this area:

- full planning permission (2011/1959) for sand and gravel extraction at Park Farm, A452 Chester Road (see Map CT-13-053, G6, Volume 2, CFA24 Map Book)[17]; and
- outline planning permission (2011/1159) for mixed-use leisure/entertainment complex at north and east of Pendigo Way (see Map CT-13-053-L1, F2, Volume 2, CFA24 Map Book).

2.1.33 However, where a committed development lies wholly or partly within the land required for the Proposed Scheme, it is assumed that the development will not be commenced or completed in its proposed form. Such developments are noted in Volume 5: Appendix CT-004-000/2.

[13] North Warwickshire Borough Council (NWBC) (2013), *North Warwickshire Local Plan Core Strategy*. NWBC.
[14] Warwickshire County Council (1995), *Minerals Local Plan for Warwickshire*. WCC.
[15] Warwickshire County Council (2009), *Minerals Core Strategy – revised spatial options.* WCC.
[16] Warwickshire County Council (2013), *Warwickshire Waste Core Strategy*. WCC.
[17] Although this is partially located in the area required for the Proposed Scheme, the phasing plan of the permission allows this to go ahead unchanged.

2.1.34 No developments have been identified which are likely to have cumulative effects, when considered together with the Proposed Scheme.

2.1.35 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[18]. The progress of these proposals is being monitored by HS2 Ltd.

2.2 Description of the Proposed Scheme

2.2.1 The following section describes the main features of the Proposed Scheme in the Birmingham Interchange and Chelmsley Wood 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 in Map series CT-06 (Volume 2, CFA24 Map Book). Land that will also be required, but only on a temporary basis for construction, is set out in Section 2.3.

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

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

- an additional 900 car parking spaces at Birmingham Interchange station;
- straightened alignment of the people mover as it approaches the Birmingham International station and Birmingham Airport;
- amendments to the alignment of the A446 Stonebridge Road to avoid the taking of land at the Coleshill and Bannerly Pools SSSI;
- the size of Coleshill Heath Road satellite compound in Heath Park was reduced to minimise the loss of open space; and
- provision for open space, north-west of the route, adjacent to Coleshill Heath Road.

Overview

2.2.5 The Proposed Scheme through this area is approximately 4.35km in length (see Maps CT-06-105b to CT-06-107-R1, Volume 2, CFA24 Map Book). The route commences south of the A45 Coventry Road in Hampton-in-Arden and proceeds north-west into a triangular site with the A452 Chester Road to the east; the M42, National Exhibition Centre (NEC) and Birmingham Airport to the west and the A45 Coventry Road to the south.

[18] For traffic and transport and topics that make use of traffic flow forecasts, future baseline and with the Proposed Scheme flows take into account all planned development, including proposed development, to establish a robust baseline.

2.2.6 Within the triangular site, a new HS2 station and associated infrastructure, known as Birmingham Interchange station, will be constructed together with a people mover and people mover depot. The people mover will provide connectivity between this new station, the NEC, Birmingham International station and Birmingham Airport.

2.2.7 Leaving the triangular site, the route will continue north-west, crossing over the M42 on viaduct, with Coleshill and Bannerly Pools SSSI to the north-east and Birmingham Business Park to the south-west. The route will then continue over the M6 on a box structure with Chelmsley Wood residential estate located to the south-west. The route will leave this area at the administrative boundary between SMBC and NWBC, in close proximity to where the M42 intersects with the M6.

Start of Birmingham Interchange and Chelmsley Wood CFA to the A45 Coventry Road

2.2.8 The approximate length of this section will be 285m. The route will leave Balsall Common and Hampton-in-Arden (CFA23) in a cutting (known as Diddington cutting), in close proximity to Pasture Farm. The depth of the cutting will range between 9.5m below ground level as the route enters this area rising to 7m close to the A45 Coventry Road. The route in this section will be a four-track layout. Key features of this section will include (see Map CT-06-105b, Volume 2, CFA24 Map Book):

- realigned access track from the A45 Service Road to the proposed Pasture Farm accommodation overbridge[19] (see Map CT-06-105b, D6, E6 and E5, Volume 2, CFA24 Map Book);
- a cut-off ditch at the top of Diddington cutting on the western side of the route to intercept surface water flows from the adjacent land to the west of the route (see Map CT-06-105b, D7, Volume 2, CFA24 Map Book). This ditch originates from Balsall Common and Hampton-in-Arden (CFA23);
- permanent underground diversion of telecommunication overhead lines commencing at the intersection of the A45 Service Road and the new Pasture Farm access track, along the existing access track southwards along Diddington Lane;
- permanent underground diversion of a Western Power high-voltage overhead power line for approximately 900m, south-west of the A45 Service Road; and
- planting of native broad-leaved woodland on the realigned earthwork slopes of the A45 Coventry Road for landscape integration and habitat replacement (see Map CT-06-105b, C7 to C8 and D5 to D7, Volume 2, CFA24 Map Book).

2.2.9 Construction of this section will be managed from the A45/A45 Service Road overbridges satellite compound (see Section 2.3).

[19] Pasture Farm and Pasture Farm accommodation overbridge is located in Balsall Common and Hampton-in-Arden (CFA23).

M42 junction 6 roundabout, A45 Coventry Road, Stonebridge Island and A452 Chester Road

2.2.10 The route will intersect the A45 Coventry Road north-east of Bickenhill Waste Recycling Centre. The route will still be in the cutting, but will gradually rise to ground level north of the A45 Coventry Road before entering into the area of the Birmingham Interchange station (see section Birmingham Interchange station and surrounding area). The approximate length of this section of the route will be 160m. In this area there will be highway works to the A45 Coventry Road/M42 junction 6 roundabout (referred to as M42 junction 6 roundabout), A45 Coventry Road, A45 Coventry Road/A452 Chester Road roundabout (referred to as Stonebridge Island) and the A452 Chester Road. The highway works will be undertaken due to the alignment of the route and to provide greater capacity to the existing highway network to facilitate travel to/from Birmingham Interchange station (see Maps CT-06-105b to CT-06-106-L1, Volume 2, CFA24 Map Book).

2.2.11 Highway improvement works associated with the M42 junction 6 roundabout (see Map CT-06-106-L1, Volume 2, CFA24 Map Book) will include:

- widening of the M42 northbound and southbound roundabout entries from three to four lanes (see Map CT-06-106-L1, H3 to I6, Volume 2, CFA24 Map Book);
- widening of the M42 junction 6 roundabout circulatory carriageway from three to five lanes between the M42 northbound roundabout entry and the M42 northbound roundabout exit road, with the existing bridge over the A45 Coventry Road widened (see Map CT-06-106-L1, H5 to H6 and I6, Volume 2, CFA24 Map Book);
- widening of the A45 Coventry Road westbound roundabout entry to provide a segregated left turn lane to the M42 southbound roundabout exit. The works associated with providing the segregated left turn lane will also require widening the circulatory carriageway of the roundabout and along the M42 southbound roundabout exit (see Map CT-06-106-L1, I4 to J6, Volume 2, CFA24 Map Book);
- widening of the A45 Coventry Road eastbound roundabout exit to two lanes (see Map CT-06-106-L1, H4 and I3, Volume 2, CFA24 Map Book);
- widening of the A45 Coventry Road eastbound roundabout entry to four lanes (see Map CT-06-106-L1, H6, Volume 2, CFA24 Map Book);
- replacement access to the National Motorcycle Museum. The existing access to the National Motorcycle Museum off the M42 junction 6 roundabout will be closed (see Map CT-06-106-L1, I4, Volume 2, CFA24 Map Book) with a replacement access provided off the A45 Service Road (see Map CT-06-106-L1, I1 to J3, Volume 2, CFA24 Map Book). Footpath M107 will be permanently realigned (see Map CT-06-106-L1, J1 to J2, Volume 2, CFA24 Map Book) parallel to the replacement access for the National Motorcycle Museum, adding an additional 50m;

- two balancing ponds for highway drainage to the north-east (see Map CT-06-106-L1, H3, Volume 2, CFA24 Map Book) and south-west (see Map CT-06-106-L1, I6 and I7, Volume 2, CFA24 Map Book) of the M42 junction 6 roundabout. A maintenance access track will be provided to each balancing pond;
- closure to vehicular traffic of a gated access off Old Station Road onto the M42 junction 6 roundabout (see Map CT-06-106-L1, I5, Volume 2, CFA24 Map Book). Access for pedestrians to Old Station Road will remain; and
- permanent diversion of a water main on the north and south side of the M42 junction 6 roundabout.

2.2.12 Highway improvement works associated with the A45 Coventry Road will include (see Maps CT-06-105b to CT-06-106-L1, Volume 2, CFA24 Map Book):

- widening of the A45 Coventry Road between the M42 junction 6 roundabout and Stonebridge Island from dual three to dual four lanes and raising the vertical alignment of the A45 Coventry Road by up to 4m on an elevated bridge structure to cross over the route (see Map CT-06-105b, Volume 2, CFA24 Map Book). The A45 Service Road and East Way both adjacent to the A45 Coventry Road will be additionally realigned and raised by more than 3m (see Map CT-06-105b, Volume 2, CFA24 Map Book);
- three road overbridges: the East Way overbridge, the A45 Coventry Road overbridge and the A45 Service Road overbridge (see Map CT-06-105b, C6 and D6, Volume 2, CFA24 Map Book) will be constructed to allow the route to pass under these roads. The height of each overbridge will be up to 10m above the route;
- modifying and raising the existing East Way Loop underbridge (see Map-CT-06-105b,C8, Volume 2, CFA24 Map Book) by up to 2m to enable the A45 Coventry Road to cross over the route;
- permanent diversion of the existing East Way carriageway, to north of its existing alignment, over an approximate length of 650m (see Map CT-06-105b, B8 to D5, Volume 2, CFA24 Map Book), and the existing A45 Service Road, to the south of its existing alignment, over an approximate length of 900m (see Map CT-06-105b, C8 to E3, Volume 2, CFA24 Map Book). These diversions will facilitate the widening of the A45 Coventry Road;
- an access road off East Way (see Map CT-06-105b, C7, Volume 2, CFA24 Map Book) to enable access to the people mover depot (see Map CT-06-105b, centred on B7, Volume 2, CFA24 Map Book) and to a balancing pond provided for railway drainage (see Map CT-06-105b, A7 and B7, Volume 2, CFA24 Map Book). Woodland and marginal planting around the balancing pond will be provided for landscape integration, visual screening and habitat replacement (see Map CT-06-105b, A7, Volume 2, CFA24 Map Book);
- a separate access road off the diverted East Way carriageway, east of the route, which will provide access to a field (see Map CT-06-105b, C5, Volume 2, CFA24 Map Book), two balancing ponds (see Map CT-06-105b, C5, to C6 and

B5 to B6, Volume 2, CFA24 Map Book) and a second maintenance access point (see Map-CT-06-105b, C6, Volume 2, CFA24 Map Book)

- a minor realignment of the access to the Bickenhill Waste Recycling Centre (see Map CT-06-105b, D7, Volume 2, CFA24 Map Book) will be provided;
- permanent diversion of a telecommunications underground lines for approximately 600m, north of the A45 Coventry Road;
- permanent diversions of multiple gas mains along the A45 Coventry Road and around Stonebridge Island totalling approximately 2.5km;
- permanent diversion of a water main along the A45 Coventry Road, totalling approximately 2.5km; and
- native broad-leaved woodland planting along both sides of the raised A45 Coventry Road for landscape integration (see Map CT-06-105b, C8 to D5, Volume 2, CFA24 Map Book).

2.2.13 The highway improvement works associated with Stonebridge Island (see Map CT-06-105b, Volume 2, CFA24 Map Book) will include:

- a segregated left turn lane for the A45 Coventry Road eastbound roundabout entry to A452 Chester Road northbound roundabout exit with associated widening (see Map CT-06-105b, E2, Volume 2, CFA24 Map Book). The access to the Toby Carvery public house and restaurant will be realigned as part of these highway works (see Map CT-06-105b, C2 and D2, Volume 2, CFA24 Map Book);
- widening and signalised approaches to Stonebridge Island from the A452 Kenilworth Road northbound roundabout entry and the A452 Chester Road southbound roundabout entry (see Map CT-06-105b-E2 and D2 respectively, Volume 2, CFA24 Map Book)). A segregated left-turn lane will be provided to the A45 Coventry Road eastbound roundabout exit and westbound roundabout exit road (see Map CT-06-105b, E2, Volume 2, CFA24 Map Book);
- widening and signalisation of the remaining approaches to the roundabout, including a segregated left-turn lane from the A452 Kenilworth Road northbound to the A45 Coventry Road westbound roundabout exit. A segregated left turn lane will also be provided from the A452 Chester Road southbound to the A45 Coventry Road eastbound roundabout exit (see Map CT-06-105b, E2 and D2 respectively, Volume 2, CFA24 Map Book);
- part signalisation of the roundabout circulatory carriageway and a new link through the centre of the existing roundabout for right-turn movements between the A452 Chester Road southbound and the A45 Coventry Road westbound (see Map CT-06-105b, E2, Volume 2, CFA24 Map Book);
- permanent underground diversion of a Western Power high-voltage overhead power line for approximately 150m to the west of Stonebridge Island (see Map-CT-06-105b, E3, Volume 2, CFA24 Map Book); and

- one balancing pond for highway drainage which will be accessed off Diddington Lane (see Map-CT-06-105b, E2 and E3, Volume 2, CFA24 Map Book). The outfall from the balancing pond will be piped across the A452 Kenilworth Road and discharged to the River Blythe (see Map-CT-06-105b, E2, Volume 2, CFA24 Map Book).

2.2.14 The highway improvement works associated with the A452 Chester Road on the southern approach to the proposed Birmingham Interchange station will include (see Map CT-06-105b and CT-06-106, Volume 2, CFA24 Map Book):

- realignment of the A452 Chester Road highway up to 60m to the east of the existing alignment (see Map CT-06-105b, C2, Volume 2, CFA24 Map Book);
- widening of the existing A452 Chester Road highway from dual two lane to dual three lane for a distance of approximately 915m between Stonebridge Island to just south of the existing Packington Lane access (see Map CT-06-105b, A3and CT-06-106, G3 to J2, Volume 2, CFA24 Map Book);
- two balancing ponds for highway drainage off the southbound carriageway with associated access tracks off the A452 Chester Road (see Map CT-06-105b, centred on C1 to D2 and A2 to B2, Volume 2, CFA24 Map Book);
- native broad-leaved woodland around the balancing pond and along the realignment of the A452 Chester Road for landscape integration and habitat replacement/connectivity (see Map CT-06-105b, A1 to D2, Volume 2, CFA24 Map Book); and
- permanent underground diversion of a Western Power high-voltage overhead power line located under the footprint of the proposed Birmingham Interchange station. The diversion is approximately 2.5km along the A452 Chester Road (see Map CT-06-105b, C2, Volume 2, CFA24 Map Book) and several other existing utilities located within the A45 Coventry Road which will be diverted within the proposed highway realignment.

2.2.15 Construction of this section will be managed through five satellite compounds: A45/A45 Service Road overbridges; East Way loop underbridge, A45/East Way overbridges, A45 /M42 junction 6 roundabout and the Birmingham Interchange station car park (east) satellite compounds (see Section 2.3). The construction of the balancing pond at Stonebridge Island will be managed from Shadow Brook underbridge in Balsall Common and Hampton-in-Arden (CFA23).

A45 Coventry Road to Hollywell Brook underbridge

2.2.16 The approximate length of the route in this section will be 400m. The Proposed Scheme will continue north-west, predominantly on embankment (known as the Bickenhill embankment), up to 3m in height, before reaching the location of the proposed Birmingham Interchange station. The route in this location will change from a four-track to a six-track layout. The route will cross Hollywell Brook upon entry to the proposed Birmingham Interchange station. Key features of this section will include (see Maps CT-06-105b to CT-06-106, Volume 2, CFA24 Map Book):

- a culvert over an unnamed watercourse which will be realigned around the A45 Coventry Road and the Proposed Scheme earthworks (see: Map CT-06-105b, C7 and C6, Volume 2, CFA24 Map Book);
- a depot for the people mover will be located on the western side of the route (see section on people mover and depot) (see Map CT-06-105b, centred on B7, Volume 2, CFA24 Map Book);
- Hollywell Brook underbridge which will allow Hollywell Brook to flow beneath the route (see Map CT-06-106, I6, Volume 2, CFA24 Map Book). The height of the underbridge will be up to 4m above ground level. The brook will be realigned for approximately 330m around the proposed Birmingham Interchange station (see Map CT-06-106, I6, I7 and H7, Volume 2, CFA24 Map Book). The existing bridge will be removed;
- marshy grassland will be planted around Hollywell Brook for habitat creation (see Map CT-06-106, J3 to G10 , Volume 2, CFA24 Map Book);
- three floodplain replacement storage areas. One will be located west of the dismantled Hampton-in-Arden to Shustoke line and north-east of Hollywell Brook. This will be excavated to a depth of approximately 0.5m below existing ground level (see Map CT-06-106, I5, Volume 2, CFA24 Map Book). The second will be located to the south of Hollywell Brook in close proximity to the A452 Chester Road (see Map CT-06-106, J3, Volume 2, CFA24 Map Book), and will be excavated to a depth of approximately 0.5m, and the third will be located west of the dismantled Hampton-in-Arden to Shustoke line, south of Hollywell Brook (see Map CT-06-106, I6, Volume 2, CFA24 Map Book) and excavated to a depth of 2m below existing ground level. The areas will be re-graded to tie back into the existing ground level; and
- four balancing ponds for drainage. Two ponds will be for railway drainage (see Map CT-06-106, I4 and J5, Volume 2, CFA24 Map Book), one pond will be for the Birmingham Interchange station car parks located east of the route (see Map CT-06-106, I3, Volume 2, CFA24 Map Book), and the remaining pond will be for the people mover depot located to the west of the Proposed Scheme, (see Map CT-06-106, I7, Volume 2, CFA24 Map Book).

2.2.17 Construction of this section will be managed from the Birmingham Interchange station main compound and two satellite compounds: the A45/East Way overbridges and Birmingham Interchange station car park (west) and people mover satellite compounds (see Section 2.3).

Birmingham Interchange station and surrounding area

2.2.18 The approximate length of this section is 1km. From Hollywell Brook underbridge, the route will pass through the proposed Birmingham Interchange station (see Map CT-06-106, H6 to G6, Volume 2, CFA24 Map Book). Figure 3 shows a visualisation of the design of the proposed Birmingham Interchange station, people mover, surrounding public realm, road infrastructure and car parking.

2.2.19 The illustrations and visualisations are provided to assist the understanding of the Proposed Scheme. The design may be developed and may be amended in the detailed design.

Figure 3: Birmingham Interchange station visualisation looking west

2.2.20 Key features of Birmingham Interchange station will include (see Maps CT-06-106,Volume 2, CFA24 Map Book):

- a station building of approximately 27m in height above the track level and 135m in length (see Map CT-06-106, H6 to G6, Volume 2, CFA24 Map Book). Due to the local topography of the area, the station building will be located partially in an 8m deep cutting (known as the Bickenhill cutting) at the northern end varying to a 5m embankment (known as the Bickenhill embankment) at the southern end;
- the station building will consist of a forecourt leading to a concourse providing retail facilities, welfare and public information, ancillary accommodation for staff and an area for international passengers (see Map CT-06-106, H6 to G6, Volume 2, CFA24 Map Book). The station will provide for domestic and international services;
- six tracks through the station; four will serve platforms and two will be through lines. The tracks will be lower than the surrounding station buildings and will pass below the entrance concourse;
- the four platform faces (each approximately 415m in length) will be arranged on two island platforms serving four tracks (see Map CT-06-106, H6 and G6, Volume 2, CFA24 Map Book). There will also be two non-stopping lines through the centre of the station;
- a platform for the people mover will be located to the north-west corner of the station (see Map CT-06-106, G7, Volume 2, CFA24 Map Book);
- two surface level terraced car parks to the east (see Map CT-06-106, centred on H5, Volume 2, CFA24 Map Book) and west (see Map CT-06-106, centred on F8, Volume 2, CFA24 Map Book) of the station and a long stay car park to the north-east of the station (see Map CT-06-106, centred on F5, Volume 2, CFA24 Map Book). The car parks will provide approximately 6,400 parking spaces. The car parks will be accessed by a network of internal roads (see Map CT-06-106, Volume 2, CFA24 Map Book);
- the station will have a short-stay car pick-up and drop-off area (see Map CT-06-106, G5, Volume 2, CFA24 Map Book), bus pick-up and drop-off area (see Map CT-06-106, G7, Volume 2, CFA24 Map Book), taxi rank and coach parking at the front of the station;
- storm water from the station building roofs and facades, will be collected and channelled via a series of gutters and rain water pipes to the below ground drainage network. Storm water will be channelled through a rainwater harvesting tank, to enable its re-use in the station;
- drainage collected from the internal road network and car parking areas will be passed through pollution control interceptors on route to the balancing ponds;
- foul water drainage will be provided throughout the station building and flows will be channelled to a pumping station located to the west of the main station

building. The foul water drainage will be pumped north, following the main internal road network and across the M42; and

- new utility supplies will be provided for the station.

2.2.21 Illustrative block plans of the three main levels of the proposed station show: the platform level showing passenger facilities (Figure 4); the concourse level with passenger facilities (Figure 5); and the mezzanine level with staff and station facilities (Figure 6).

Figure 4: Birmingham Interchange station block plan: platform level

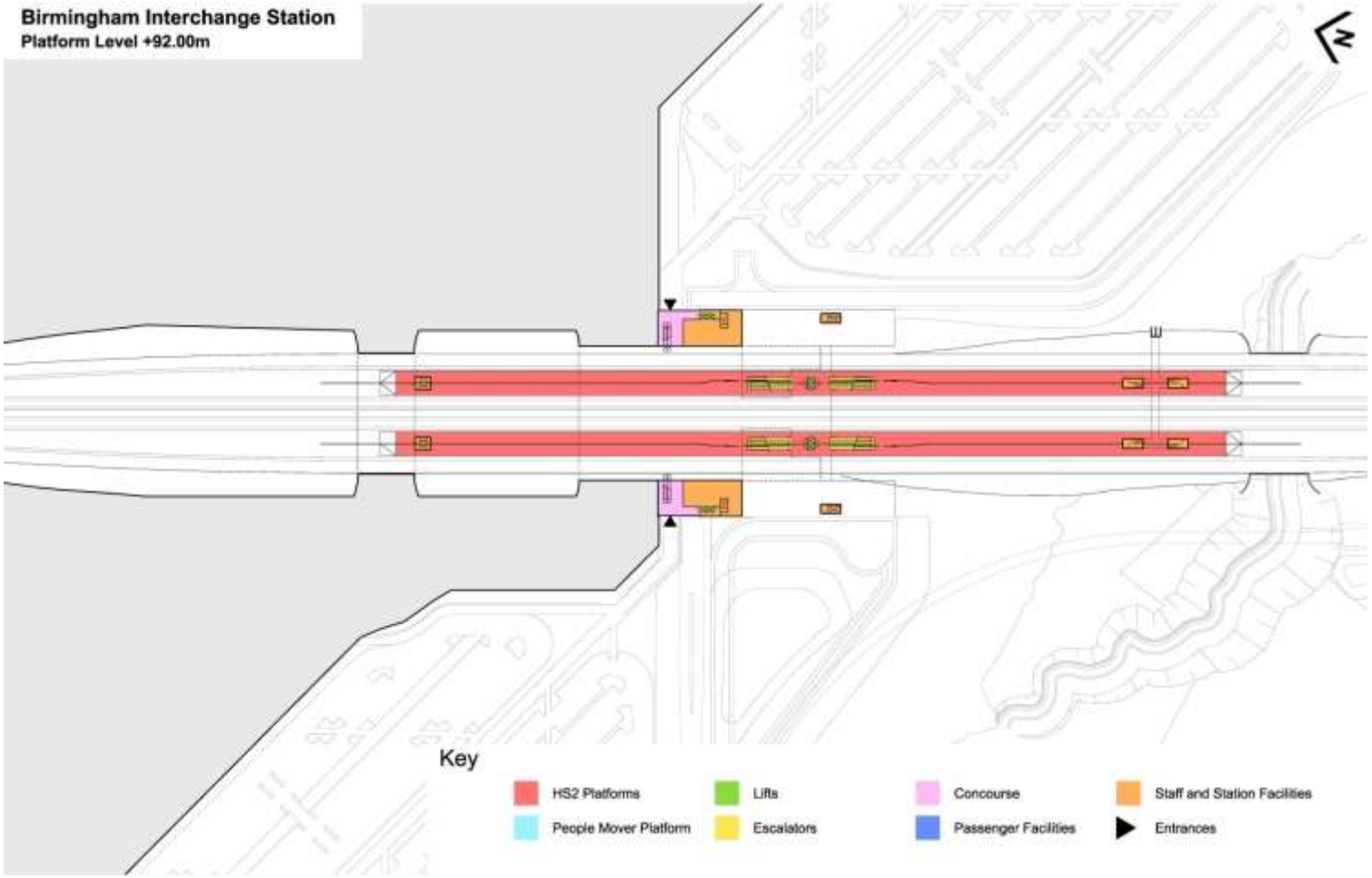


Figure 5: Birmingham Interchange station block plan: concourse level

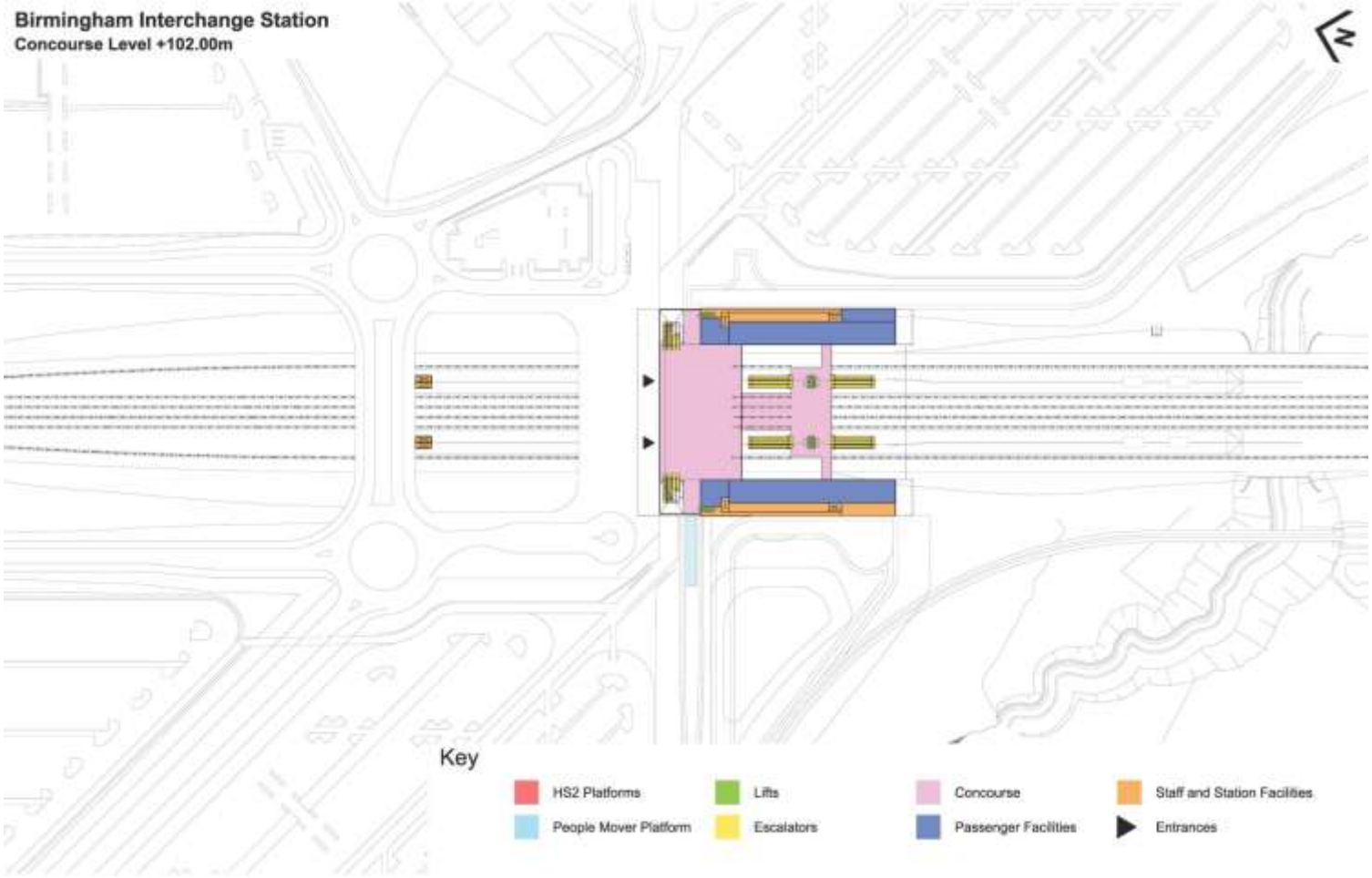
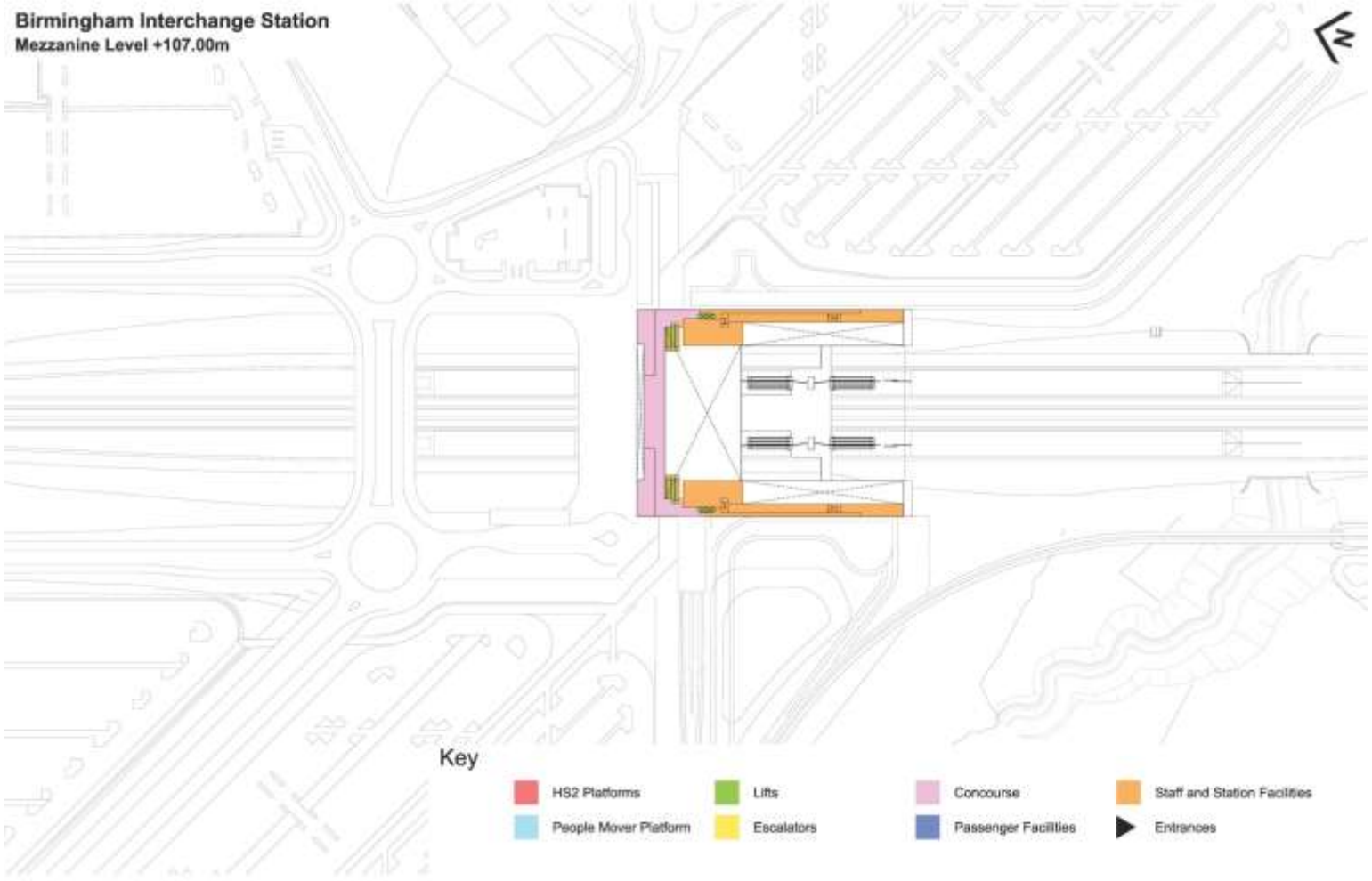


Figure 6: Birmingham Interchange station block plan: mezzanine level



2.2.22 Illustrative cross sections and elevations of the station are shown in Figures CT-20-016, CT-20-017 and CT-20-018 (Volume 2, CFA24 Map Book). Under the hybrid Bill, the detailed designs will be subject to the later approval of SMBC as the local planning authority.

2.2.23 Artist's sketches (see Figures LV-14-009 to LV14-011, Volume 2, CFA24 Map Book) illustrate how the completed station could appear from key viewpoints.

2.2.24 The station will operate as one entity, with easy connections to other transport modes, as shown in Figure 7.

Figure 7: Birmingham Interchange station: intermodal connections

2.2.25 Additional design features of this section will include (see Maps CT-06-106, Volume 2, CFA24 Map Book):

- a network of internal roads to provide access to the station and car parks (see Map CT-06-106, Volume 2, CFA24 Map Book). These internal roads will connect to the new A452 /A446 roundabout (see Map CT-06-106,centred on C6, Volume 2, CFA24 Map Book) (see section on A452 /A446 roundabout and surrounding area highway works). The internal roads will be connected by an overbridge (known as Birmingham Interchange access overbridge) which will be approximately 9m high (see Map CT-06-106, F6, Volume 2, CFA24 Map Book);
- A452 Station Entry Link road will be provided off the realigned dual three-lane A452 Chester Road to a new roundabout located east of the station (see Map CT-06-106, G4 and G5, Volume 2, CFA24 Map Book). The roundabout will provide access to the Birmingham Interchange station east car park. The exit road onto the A452 Chester Road will cross under the existing carriageway and merge onto the southbound A452 Chester Road (see Map CT-06-106, G3 , Volume 2, CFA24 Map Book);
- one balancing pond for highway drainage and associated access track will be provided off the exit link onto the A452 Chester Road. The pond will outfall to an unnamed watercourse (see Map CT-06-106, G2, Volume 2, CFA24 Map Book);
- native broad-leaved planting around the exit link onto the A452 Chester Road and balancing pond for landscape integration (see Map CT-06-106, F1 to H3, Volume 2, CFA24 Map Book);
- Middle Bickenhill Lane will remain open from East Way to the intersection with the proposed people mover, the remaining section from this point to the A452 Chester Road will be closed (see Map CT-06-106, G8 to E4, Volume 2, CFA24 Map Book);
- planting along Middle Bickenhill Lane and along the dismantled Hampton-in-Arden to Shustoke line for landscape integration (see Map CT-06-106, H7 and I4 respectively, Volume 2, CFA24 Map Book);
- native broad-leaved woodland to the south and west of Park Farm, a Grade II* listed building, for visual screening (see Map CT-06-106, F5 to G4, Volume 2, CFA24 Map Book);
- several areas of native broad-leaved woodland and soft landscaping to provide landscape integration, visual screening and habitat creation will be planted in the surrounding area;
- culverting of an unnamed watercourse at Denbigh Spinney underneath the Proposed Scheme north of the Birmingham Interchange station (see: Map CT-06-106, D6, Volume 2, CFA24 Map Book);
- four other balancing ponds for drainage associated with railway, car parks and the internal road network with associated access tracks and proposed planting

around each balancing pond for landscape integration (see Map CT-06-106, G7, D5, E5, and D8, Volume 2, CFA24 Map Book);

- permanent diversion of a multiple water mains for approximately 300m, west of Middle Bickenhill Lane;
- a telecommunications mast located on Middle Bickenhill Lane within the footprint of the proposed Birmingham Interchange station will be repositioned approximately 400m to the west; and
- permanent underground utility diversion of an existing Western Power high-voltage overhead power line east of Middle Bickenhill Lane and the permanent underground diversion of a Western Power high-voltage overhead power line for approximately 800m west of Middle Bickenhill Lane (see Map CT-06-106, E4 to G9, Volume 2, CFA24 Map Book). This will involve the removal of three transmission towers. Permanent diversion of a water main west of Middle Bickenhill Lane.

2.2.26 Exiting Birmingham Interchange station, the route of the Proposed Scheme will continue north-west to the A452/A446 roundabout (see Map CT-06-106, C6, Volume 2, CFA24 Map Book) (see section on A452/A446 roundabout and surrounding area highway works) changing from a six-track to a four-track layout (see Map CT-06-106, D6 and E6, Volume 2, CFA24 Map Book).

2.2.27 Construction of this section will be managed from three compounds: the Birmingham Interchange station main compound, Birmingham Interchange station car park (east) and A452/A446 roundabout satellite compounds (see Section 2.3).

People mover and people mover depot

2.2.28 A people mover track system of up to 17m in height and approximately 2.3km in length will operate from the Birmingham Interchange station, moving south-west crossing over the M42, East Way, Pendigo Lake and the Rugby to Birmingham line before continuing onto Birmingham Airport (see Maps CT-06-106, CT-06-106-L1 and CT-06-106-L2, Volume 2, CFA24 Map Book). There will be four stops along the route of the people mover, which will be at Birmingham Interchange station (see Map CT-06-106, G7, Volume 2, CFA24 Map Book), the NEC (see Map CT-06-106-L1, E8, Volume 2, CFA24 Map Book), Birmingham International station (see Map CT-06-106-L2, D3, Volume 2, CFA24 Map Book), and Birmingham Airport (see Map CT-06-106-L2, C5, Volume 2, CFA24 Map Book).

2.2.29 The people mover will operate seven days a week, with the first service operating approximately 30 minutes before the departure of the first HS2 train to 15 minutes after the arrival of the last HS2 train.

2.2.30 The route and structural proposals of the people mover have been designed to allow a system that will provide for movement of at least 2,100 passengers per direction per hour at peak times, running at three minute intervals and speeds of up to 90km per hour. Waiting times will normally not exceed four minutes, but will be up to a maximum of 15 minutes during major NEC events. The journey time from Birmingham Interchange station to Birmingham Airport will be approximately six minutes.

2.2.31 A single-storey depot for the people mover approximately 60m in length and 7.5m in height with a steel framed roof will be located to the south-west of the Birmingham Interchange station set in shallow cutting (see Map CT-06-105b, A7, B7 and C7, Volume 2, CFA24 Map Book). The depot will be accessed via an access road off the East Way (see Map CT-06-105b, C7, Volume 2, CFA24 Map Book). The depot will facilitate the maintenance of the people mover. Parking will be provided for maintenance staff.

2.2.32 Additional design features of this section will include:

- maintenance access tracks, accessed off Middle Bickenhill Lane, will be provided parallel to the people mover within the Birmingham Interchange station site (see: Map CT-06-106, G8, G7 and H7, Volume 2, CFA24 Map Book);
- permanent diversion of a National Grid overhead power line for approximately 800m which will be raised from its current alignment by a suitable height to avoid the proposed people mover (see Map CT-06-106-L1, F3 to G5, Volume 2, CFA24 Map Book) ;
- permanent underground diversion of a Western Power high-voltage overhead power line, to the north-west of M42 junction 6 for approximately 300m (see Map CT-06-106-L1, G5 to F4, Volume 2, CFA24 Map Book); and
- native broad-leaved woodland planting to the north-east and north-west of Middle Bickenhill Lane to provide visual screening of the people mover and the Birmingham Interchange station (see Map CT-06-106, G8 and H7, Volume 2, CFA24 Map Book).

2.2.33 Construction of this section will be managed from six compounds: Birmingham Interchange station car park (west) and people mover depot; People mover (M42); People mover Pendigo Lake; People mover NEC station; People mover Birmingham International station; and People mover Birmingham Airport station satellite compounds (see Section 2.3).

A452/A446 roundabout and associated highway works

2.2.34 This section is at the northern end of the Birmingham Interchange station and covers the new A452/A446 roundabout (see CT-06-106, C5, C6 and C7, Volume 2, CFA24 Map Book) and is approximately 180m long. The new A452/A446 roundabout will reconnect the existing road network dissected by the route and will provide access south-east to Birmingham Interchange station. The new roundabout will be located south-east of the existing roundabout over the M42 and will be located over the route. Two existing low voltage overhead power lines will be diverted north-west of the new roundabout.

2.2.35 Highway works associated with the new A452/A446 roundabout (see Map CT-06-106, centred on C6, Volume 2, CFA24 Map Book) and connecting roads will include:

- a new A452/A446 roundabout to replace the existing roundabout over the M42 which is displaced by the route passing over the M42 on viaduct (see Map CT-06-106, centred on C6, Volume 2, CFA24 Map Book);

- diversion of the A452 Chester Road northbound carriageway just north of where it diverges from the northbound A446 Stonebridge Road (see Map CT-06-106, D5, Volume 2, CFA24 Map Book) and provision of a new A452 northbound off link road to the east corner of the A452/A446 roundabout (see Map CT-06-106, C5 and D5, Volume 2, CFA24 Map Book). The existing carriageway will be removed up to Common Farm, but access will still be maintained;

- the closure of the existing A452 Chester Road southbound carriageway. The carriageway will be removed just south of Melbicks Garden and Leisure centre (see Map CT-06-107, J5, Volume 2, CFA24 Map Book). The existing structure over the A446 Stonebridge Road will be additionally removed (see Map CT-06-106, B5, C4 and D4, Volume 2, CFA24 Map Book) and a new A452 southbound link road will be constructed between the east corner of the A452/A446 roundabout and the existing A452 Chester Road southbound carriageway, approximately 200m north of Packington Lane (see Map CT-06-106, C5, D4 and E4, Volume 2, CFA24 Map Book). The new A452 southbound link road will require a new structure over the existing A446 Stonebridge Road (see Map CT-06-106, C4 and D4, Volume 2, CFA24 Map Book);

- a new access road will be provided for Melbicks Garden and Leisure centre off the A452/A446 roundabout (see: Map CT-06-107, I5, Volume 2, CFA24 Map Book), this access road will also provide an entry to Quartz Point Business Park (see Map CT-06-107, I5 and H5, Volume 2, CFA24 Map Book);

- a new A446 southbound off link, to the west of Melbicks Garden and Leisure centre, connecting into the northern corner of the A452/A446 roundabout (see Maps CT-06-106, B5, Volume 2, CFA24 Map Book);

- northbound traffic heading to M6 junction 4 and Coleshill from the Birmingham Interchange station will use the realigned A446 northbound on link (see Maps CT-06-106, B6 to B5,Volume 2, CFA24 Map Book) which will run parallel to the A446 southbound off link before connecting back into the existing merge lane to the A446 Stonebridge Road (see Maps CT-06-107, F3, Volume 2, CFA24 Map Book);

- a new A452 link road, which will be dual carriageway (see: Map CT-06-106, B7, Volume 2, CFA24 Map Book), from the north-west corner of the A452/A446 roundabout, which will cross the M42 before connecting with a new A452/B4438 roundabout (see Map CT-06-107, G8, H8, G9 and H9, Volume 2, CFA24 Map Book) and with new connections to the B4438 Bickenhill Parkway Link and Solihull Parkway. The new roundabout will replace an existing roundabout; and

- realignment of the existing B4438 Bickenhill Parkway Link dual carriageway (see Map CT-06-107, G7 and G8, Volume 2, CFA24 Map Book) and provision of a new roundabout on the west side of the existing A452/A446 roundabout (see Map CT-06-107, G7 and F7, Volume 2, CFA24 Map Book). This roundabout will serve Birmingham Business Park and provide connections to the A452 Chester Road (see Map CT-06-107, F7, Volume 2, CFA24 Map Book).

2.2.36 Additional key features in this area will include:

- an auto-transformer station located to the north-east of the A452 link road with an associated access track (see Map CT-06-107, I7 and J7, Volume 2, CFA24 Map Book). Native broad-leaved woodland will be planted around the auto-transformer station it for landscape integration;
- two balancing ponds for highway drainage located south-west of the A452 Link Road (see Map CT-06-107, H8, H9, J7 and I8, Volume 2, CFA24 Map Book). One balancing pond will be accessed from a track and the other will be from a lay-by off Northway. Native broad-leaved woodland and soft landscaping will be planted around the balancing ponds for landscape integration and visual screening of users of the A452 link road;
- two new field accesses will be provided, one south-west and one north-east of the A452 link road (see Map CT-06-107, I7 and J8, Volume 2, CFA24 Map Book);
- permanent diversion of several utilities in the area, including:
  - an underground diversion of a Western Power high-voltage overhead power line from an existing transmission tower located between Northway and the M42. The diversion will take place along the Northway and then along the B4438 Bickenhill Parkway Link road and the A452 Chester Road before connecting back in with the existing underground supply on A452 Chester Road (see Maps CT-06-107, I8 to E7, Volume 2, CFA24 Map Book);
  - permanent underground diversion of an existing Western Power high-voltage overhead power line for approximately 1.6km, adjacent to the A446 Stonebridge Road and internal station access roads;
  - permanent diversion of a National Grid high-voltage overhead power line diversion between an existing transmission tower located to the west of the proposed A452/A446 roundabout through to an existing transmission tower located just off the A446 southbound off link and adjacent to Quartz Point Business Park (see Map CT-06-106, A6 to C8, and Map CT-06-107, G5 to J8, Volume 2, CFA24 Map Book). Two new transmission towers will be provided for this diversion just north of Common Farm between the route and the A446 northbound on link (see Map CT-06-107, I6, Volume 2, CFA24 Map Book) and just north of A452 Link Road, near the auto-transformer station (see Map CT-06-107, J7, Volume 2, CFA24 Map Book);
  - permanent diversion of a 125mm diameter water main for approximately 3km into the A452/A446 roundabout north overbridge;
  - permanent diversion of telecommunications underground cable for approximately 350m into the A452/A446 roundabout north overbridge;
  - a new electricity supply from the electricity substation located near to Quartz Point Business Park will be provided along the A446 northbound on and southbound off links and A452 link road and will connect into the proposed Birmingham Interchange station;

- native broad-leaved woodland and marginal planting will be provided around the A452/A446 roundabout, Birmingham Interchange station and around Common Farm for landscape integration, visual screening and habitat creation (see Maps CT-06-106 and CT-06-107, Volume 2, CFA24 Map Book); and
- planting along the east and west side of the route to provide visual screening for users of Birmingham Business Park (see Map CT-06-107, Volume 2, CFA24 Map Book).

2.2.37 Construction of this section will be managed from four satellite compounds: the M42 motorway viaduct (west); the M42 motorway viaduct (east); Birmingham Interchange station car park (east); and A452/A446 roundabout satellite compounds (see Section 2.3).

A452 Chester Road /A446 Stonebridge Road roundabout to the end of Birmingham Interchange and Chelmsley Wood CFA

2.2.38 The approximate length of this section will be 2.3km. From the A452/A446 roundabout (see Map CT-06-106, C5, C6 and C7, Volume 2, CFA24 Map Book) the route will continue north-west on embankment (known as the Packington embankment), up to 6m in height, to the M42 motorway viaduct (see Map CT-06-107, G6, Volume 2, CFA24 Map Book). The viaduct, as it crosses the M42 at an angle, will be approximately 215m in length and up to 8m in height from existing ground level to the west of the M42 cutting. On leaving the viaduct the route will continue on embankment (known as the Pool Wood embankment) up to 11m in height before entering Coleshill Junction (CFA19) at the administrative boundary between SMBC and NWBC (see Map CT-06-107-R1, D6, Volume 2, CFA24 Map Book), in close proximity to where the M42 intersects with the M6, at its northern boundary. The Proposed Scheme will cross Footpath M83[20]. The route will leave this section on a box structure crossing the M6 and its road connections to the M42 (see Map CT-06-107-R1, D8, Volume 2, CFA24 Map Book). The M6 motorway box structure will be approximately 150m in length (see Map CT-06-107-R1, D6, Volume 2, CFA24 Map Book).

2.2.39 Highway improvement works associated with this section will include:

- widening of the northbound carriageway of the A446 Stonebridge Road from two to three lanes (see Map CT-06-107-R1, I4, Volume 2, CFA24 Map Book). The widening will take place in the existing central reserve. The entry to M6 junction 4 from the A446 Stonebridge Road northbound carriageway will be widened to three lanes and be signalised (see Map CT-06-107-R1, H2, Volume 2, CFA24 Map Book);
- widening of the circulatory carriageway of the M6 junction 4 to four lanes between the A446 Stonebridge Road northbound roundabout entry and M6 northbound roundabout exit (see Map CT-06-107-R1, G4, Volume 2, CFA24 Map Book). This will require the widening of an existing bridge over the M6-M42 link road (see Map CT-06-107-R1, G4, Volume 2, CFA24 Map Book);

[20] Footpath M83 was stopped up in 1972 as confirmed by Solihull Metropolitan Borough Council.

- widening of the circulatory carriageway of M6 junction 4 to three lanes, this will be mainly carried out within the existing carriageway cross section (see Map CT-06-107-R1, G2 ,H3, and G3, Volume 2, CFA24 Map Book);
- widening of the entry road to M6 junction 4 off the M6 southbound carriageway to three lanes and signalisation (see Map CT-06-107-R1, F3, Volume 2, CFA24 Map Book);
- widening of the A446 Stonebridge Road southbound entry road to M6 junction 4 to three lanes and signalisation (see Map CT-06-107-R1, F2, Volume 2, CFA24 Map Book);
- widening of the entry road to M6 junction 4 off the M6 northbound carriageway to three lanes. The existing traffic signals will be retained (see Map CT-06-107-R1, H2 to G3, Volume 2, CFA24 Map Book); and
- Coleshill Heath Road will be lowered locally by approximately 0.5m to enable the route to cross over the Coleshill Heath Road underbridge, which will be a single span bridge and approximately 7m high (see Map CT-06-107-R1, E7, Volume 2, CFA24 Map Book).

2.2.40 Key features of this section will include:

- native broad-leaved woodland and marginal planting along the route for landscape integration and visual screening (see Maps CT-06-106, CT-06-107 and CT-06-107-R1, Volume 2, CFA24 Map Book);
- diversion of an existing National Grid high-voltage overhead power line for approximately 2.2km over the M6/M42 junction and Coleshill Heath Road (see Map CT-06-107, A5 to H9, Volume 2, CFA24 Map Book). As part of this diversion a transmission tower will be removed from Heath Park (see Map CT-06-107-R1, D9 , Volume 2, CFA24 Map Book);
- permanent diversion of a Western Power low-voltage underground power line for approximately 150m, under the existing alignment, approximately 500m south of Coleshill Heath Road;
- permanent diversion of a Western Power high-voltage overhead power line for approximately 375m, located to the east side of the route, directly south of Coleshill Heath Road;
- permanent relocation of a mobile telecommunications mast, directly south of Coleshill Heath Road, on the centre line of the route. A suitable alternative location for the mobile telecommunications mast will be identified within the land required for the Proposed Scheme;
- permanent diversion of a National Grid gas main for approximately 150m, along Coleshill Heath Road, within the new road layout;
- Permanent diversion of water main along Coleshill Heath Road for approximately 250m, within the new road layout;

- two balancing ponds for highway drainage with associated access tracks. One balancing pond is located in the field east of the A446 Stonebridge Road (see Map CT-06-107, D2, Volume 2, CFA24 Map Book) one is located to the north-east of M6 junction 4 within Coleshill Junction (CFA19) (see Volume 2: Map CT-06-107-R1, F1 and F2);
- two balancing ponds for railway drainage are located to the west of the route adjacent to the Pool Wood embankment (see Map CT-06-107, A6 to D7, Volume 2, CFA24 Map Book);
- a new drainage ditch from the outfall of the balancing pond located north-east of M6 junction 4, within Coleshill Junction (CFA19) which will run parallel along the top of the southbound M6 carriageway slope and discharge into an existing unnamed watercourse (see: Map CT-06-107-R1, F2, to H1, Volume 2, CFA24 Map Book);
- native broad-leaved woodland planting along the northbound diverge off the M6 onto M6 junction 4 for habitat creation and connectivity with the Coleshill and Bannerly Pools SSSI (see Map CT-06-107-R1, H2, Volume 2, CFA24 Map Book); and
- Pool Wood embankment of approximately 925m in length adjacent to the A452 Chester Road and Birmingham Business Park to the west of the Proposed Scheme (see Map CT-06-107-R1, E7 to J9. The embankment will provide visual screening and will act as noise bund for Birmingham Business Park. A noise fence barrier ranging from 1.4m to 3m in height will be installed as a continuation on the western side for approximately 250m in this area, continuing into Coleshill Junction (CFA19) (see Map CT-06-107-R1, E7, see Volume 2 CFA24 Map Book). The noise barrier fence will mitigate noise impacts on users of Heath Park and residents off Yorkminster Drive.

2.2.41 Construction of this section will be managed from four satellite compounds: the A452/A446 roundabout, M42 Motorway viaduct (west) M6 junction 4 and Coleshill Heath Road underbridge satellite compounds (see Section 2.3).

2.3 Construction of the Proposed Scheme

2.3.1 This section sets out the strategy for construction of the Proposed Scheme in the Birmingham Interchange and Chelmsley Wood 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 (Figure 11).

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 would be required permanently by the Proposed Scheme (see Section 2.2), land would be required on a temporary basis for construction. Key temporary construction features are illustrated on the construction Map series CT-05 (Volume 2, CFA24 Map Book). Following construction works, land required temporarily would be prepared for its eventual end use, which would 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 would comprise the following general stages:

- advance works, including: site investigations further to those already undertaken; preliminary mitigation works; and preliminary enabling works;
- civil engineering works, including: establishment of construction compounds; site preparation and enabling works; main earthworks and structure works; site restoration;
- railway installation works, including: establishment of construction compounds; infrastructure installation; connections to utilities and network; 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 the draft 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 2);
- 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, temporary habitat creation and translocation, and built heritage survey and investigation;
- 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;
- railway installation works, such as laying ballast or track concrete slab and tracks, and installing power supply and communications features.

2.3.9 The construction of the scheme will be subdivided into sections, each of which will be managed from compounds. The compounds will act as the main interface between the construction work sites and the public highway, as well as performing other functions as described below. Compounds will either be main compounds or satellite compounds, 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 Birmingham Interchange and Chelmsley Wood area there will be one main construction compound and 16 satellite construction compounds for civil engineering works. In addition, a concrete batching and pre-cast storage compound, a logistics and storage compound, a temporary workers accommodation satellite compound and two vehicle recovery compounds will be located in the area. One satellite construction compound, M6 junction 4 satellite compound, is located in the Coleshill Junction area, but will support works in the Birmingham Interchange and Chelmsley Wood area. Further, there will be two satellite construction compounds for rail installation works, one of which will use a compound previously established for civil engineering works.

2.3.11 Figure 8 and Figure 9 show the management relationship for civil engineering works compounds and Figure 10 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;
- necessary operational parking; 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:

- roadheads will require an additional area of land adjacent to the compound 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.

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 8: Schematic of site compounds for civil engineering, structural and highway construction works

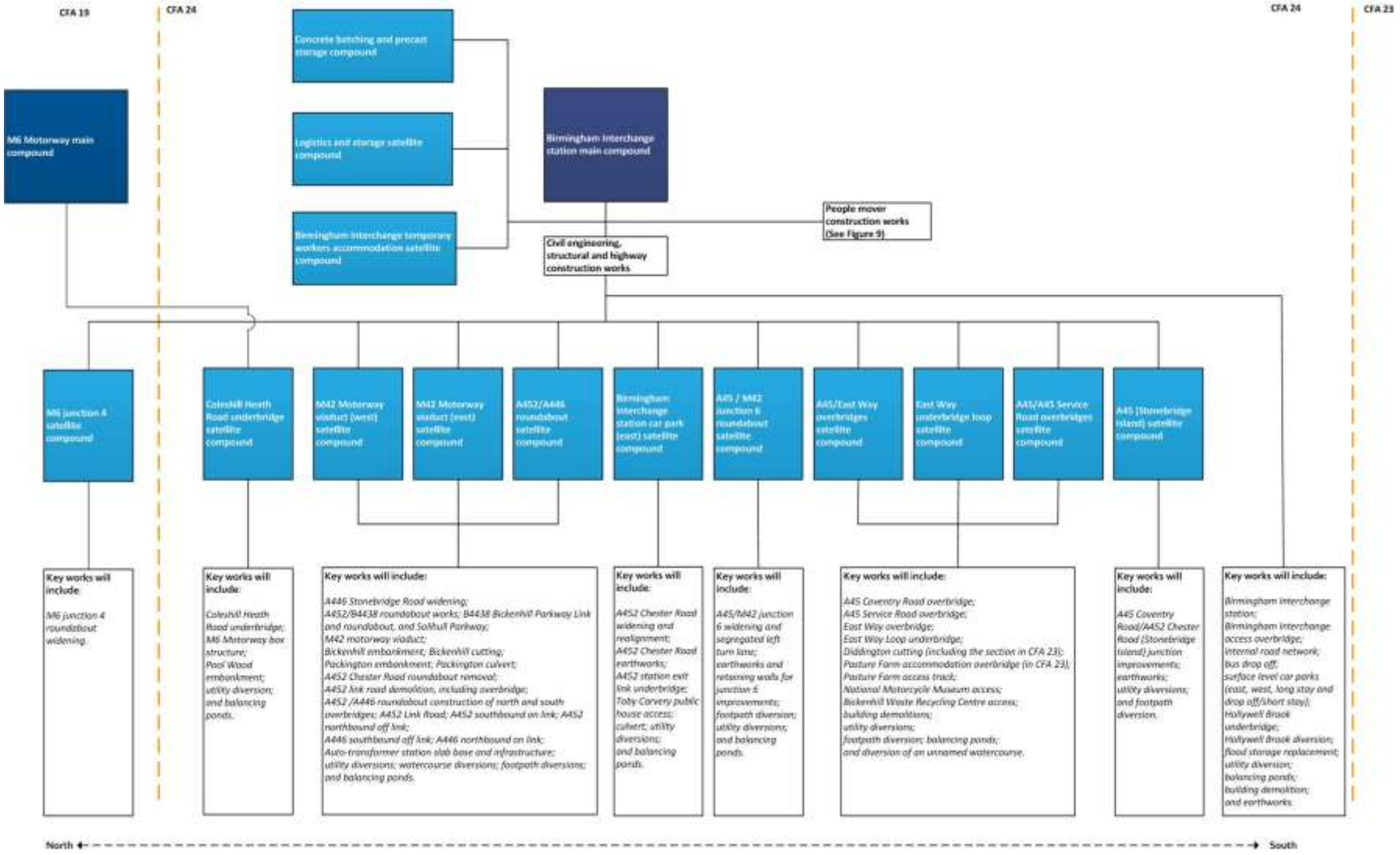


Figure 9: Schematic of site compounds for people mover construction works

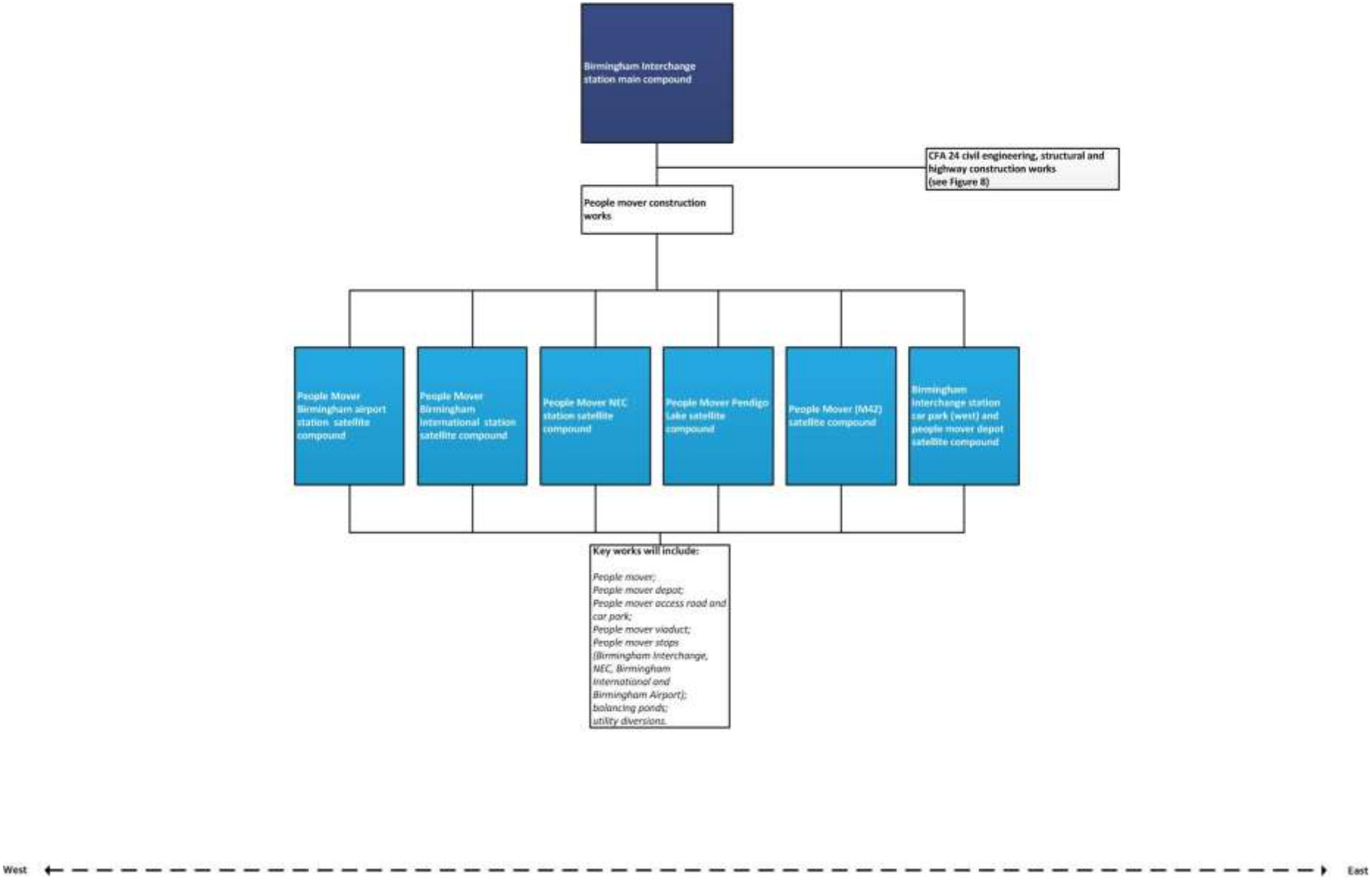
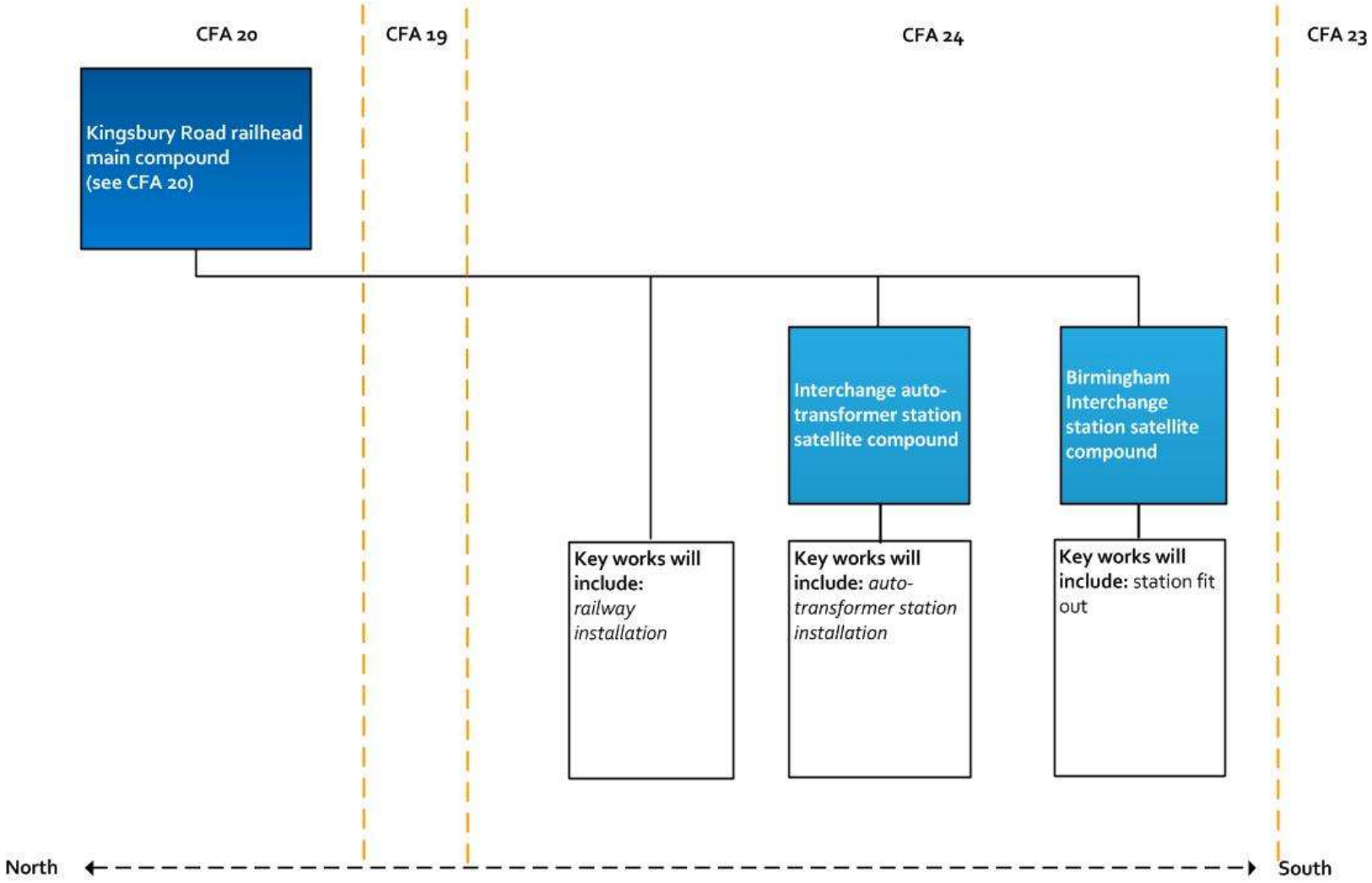


Figure 10: Schematic of site compounds for railway installation works



2.3.19 This section on construction compounds has been structured in accordance with Figure 8 and Figure 9, with Birmingham Interchange station main compound and followed by construction compounds associated with civil engineering works ordered from south to north; and then construction compounds associated with the people mover ordered from east to west. The satellite compound for rail installation works is detailed in Figure 10.

Birmingham Interchange station main compound

2.3.20 This main compound (see Map CT-05-106, E7 to F7, Volume 2, CFA24 Map Book) will be located within the footprint of the Birmingham Interchange station between Middle Bickenhill Lane and the M42. This compound will provide for the civil engineering works predominantly for the construction of the proposed Birmingham Interchange station, internal road network, car parks, earthworks and utility diversions; and watercourse realignments.

2.3.21 The main compound will provide support for 16 of the satellite compounds as illustrated on Figure 8 and Figure 9, located within this section of the Proposed Scheme.

2.3.22 The main compound for the civil engineering works will:

- be operational for approximately five years and six months, commencing in approximately 2017;
- support approximately 235 workers each day throughout much of this period;
- provide worker accommodation (see section on Birmingham Interchange station temporary workers accommodation satellite compound);
- be accessed via Middle Bickenhill Lane during site establishment, with all subsequent works accessed directly from the A452 Chester Road. A network of haul roads will be located within this area connecting the main compound with the satellite compounds it supports, as well as roadheads and temporary material stockpiles; and
- provide areas for temporary materials stockpile (see Map CT-05-106, centred on I10, Volume 2, CFA24 Map Book).

2.3.23 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- demolition of one building at the Olympia Motorcycle Track;
- utility diversions;
- construction of balancing ponds;
- construction of Hollywell Brook underbridge (see Map CT-05-106, I6, Volume 2, CFA24 Map Book);

- permanent realignment of Hollywell Brook and flood storage replacement areas;
- earthworks to lower the level of the existing site in the northern section and to raise the level in the southern section;
- construction of the internal road network, Birmingham Interchange access overbridge, bus drop off and surface level car parks (east, west, long stay and drop off/short stay);
- construction of the proposed Birmingham Interchange station (see Map CT-05-106, G6 and H6, Volume 2, CFA24 Map Book); and
- reinstatement, planting, landscaping and urban realm.

2.3.24 Demolition of one commercial property will be required (Olympia Motorcycle Track) on Middle Bickenhill Lane. See Volume 1, Section 6.7 for a description of site clearance, enabling works and site mobilisation technique that will be adopted.

2.3.25 Diversion of a number of known utilities will be required. See Volume 1, Section 6.5 under advance works for a description of the utilities construction technique that will be adopted. The key utility diversions are:

- permanent underground diversion of a Western Power overhead high-voltage power line crossing Birmingham Interchange station south to north for approximately 800m (see Map CT-05-106, E4 to G10, Volume 2, CFA24 Map Book);
- permanent relocation of a telecommunications mast on Middle Bickenhill Lane, containing a number of mobile phone transmitters, repositioned approximately 400m west of its existing location; and
- permanent diversion of multiple water mains for approximately 300m within the footprint of the proposed Birmingham Interchange station west of Middle Bickenhill Lane.

2.3.26 This compound will be used to manage the construction of Hollywell Brook underbridge, allowing Hollywell Brook to be permanently realigned for 330m and perpendicular to the route. Construction will take approximately one year to complete. See Volume 1, Section 5.10 for a description of typical bridges and Section 6.17 for associated construction techniques that will be adopted.

2.3.27 Three floodplain replacement storage areas will be constructed adjacent to Hollywell Brook. See Volume 1, Section 6.9 for a description of the drainage and watercourse realignment construction technique that will be adopted.

2.3.28 Two balancing ponds, one to collect railway run off water and one to collect run-off from the car park and associated access roads will be constructed. See Volume 1, Section 6.9 for a description of the drainage and watercourse realignment construction technique that will be adopted.

2.3.29 Birmingham Interchange station internal road network and construction of Birmingham Interchange access overbridge will be undertaken in advance of the

construction of the proposed station to facilitate access for construction. The construction of the internal road network will take approximately six months to complete. The Birmingham Interchange access overbridge will take approximately nine months to construct. The surface level car parks (east, west, long stay and drop off/short stay) will take approximately nine months to complete.

2.3.30 Material used to level the site of the Birmingham Interchange station will be received locally within Birmingham Interchange and Chelmsley Wood area from Bickenhill cutting, with surplus material being transferred to Bickenhill embankment, Pool Wood embankment and earthworks in Coleshill Junction (CFA19).

2.3.31 The construction of the proposed Birmingham Interchange station will take approximately four years to complete. A simplified construction sequence for Birmingham Interchange station is proposed to be adopted as follows:

- Phase 1: enabling works will be carried out in advance of the main construction works including; site investigation works and statutory utility diversions;
- Phase 2: establishment of the construction compound, haul roads, site clearance and excavation of ground;
- Phase 3: installation of piles, excavation to form the basement and construction of ground beams and basement slabs;
- Phase 4: installation of tower cranes to facilitate placing of precast units;
- Phase 5: lifting of the pre-cast panels into position to form the concrete superstructure up to concourse level consisting of columns, suspended slabs, and walls;
- Phase 6: construction of station steel superstructure up to roof level;
- Phase 7: installation of cladding panels to form the exterior walls;
- Phase 8: installation of the station roof;
- Phase 9: installation of mechanical, electrical and public health systems;
- Phase 10: internal station finishes including internal cladding, blockwork walls, windows, doors, flooring, and ceilings;
- Phase 11: external urban realm including footpaths, block paving, bollards and landscaping; and
- Phase 12: reinstatement, including the removal of haul roads.

2.3.32 No temporary alternative routes or permanent diversions of PRoW will be required.

2.3.33 Finalisation works will include reinstatement, planting, landscaping, urban realm and commissioning of Birmingham Interchange station.

Birmingham Interchange station satellite compound

2.3.34 This compound will provide directly for the railway systems installations associated with the fit out of Birmingham Interchange station. The compound will:

- be operational for approximately one year, starting in 2023;
- support approximately 25 workers each day throughout this period;
- be located on the same site as the Birmingham Interchange station main compound, with the site reduced in size;
- be accessed from the A452 Chester Road; and
- be managed from Kingsbury Road Railhead main compound located in Curdworth to Middleton (CFA20) (see Figure 10).

2.3.35 Key railway systems installation works in this section of the Proposed Scheme will include the fitting out of railway systems at Birmingham Interchange station. See Volume 1, Section 6.22 for a typical railway installation method.

Kingsbury Road railhead main compound (see CFA20)

2.3.36 This compound is not located within the Birmingham Interchange and Chelmsley Wood area and no works will be directly undertaken from it in this area but it will provide support to all railway installation works, as illustrated in Figure 10. See Curdworth and Middleton (CFA20) for more information regarding this compound.

Concrete batching and precast storage compound

2.3.37 This compound, located north-east of the M42, will provide concrete supply to the construction works within this area and possibly adjacent areas (see Map CT-05-106, centred on D8, Volume 2, CFA24 Map Book).

Logistics and storage satellite compound

2.3.38 The logistics and storage satellite compound will occupy a portion of the southern part of the interchange triangle between Middle Bickenhill Lane and the M42 junction 6, to the north of the Birmingham Interchange station workers accommodation satellite compound (see Map CT-05-106, centred on G9, Volume 2, CFA24 Map Book). This compound will provide an area for the storage of bulk materials (aggregates, structural steel, and steel reinforcement) and for the fabrication of temporary works equipment, fuel plant and equipment storage and parking.

Birmingham Interchange temporary workers accommodation satellite compound

2.3.39 This compound will provide worker accommodation and welfare facilities for approximately 110 workers will be in place for approximately five years and six months, but will be operational for approximately four year and three months (see Map CT-05-106-L1, G2, Volume 2, CFA24 Map Book). The accommodation will occupy a portion of the southern part of the interchange triangle between Middle Bickenhill Lane and the M42 junction 6. Workers will commute daily to the construction compounds by using either company vehicles or their own private transport.

A45 (Stonebridge Island) satellite compound

2.3.40 This compound (see Map CT-05-105b, E1, Volume 2, CFA24 Map Book) will provide for civil engineering works predominantly associated with Stonebridge Island. The compound will:

- be operational for approximately one year and six months, commencing in approximately 2017;
- support approximately 15 workers each day throughout much of this period;
- be accessed off the A45 Coventry Road westbound exit slip road;
- not provide worker accommodation;
- provide an area for temporary materials stockpile adjacent to the compound and traffic management equipment within the compound (see Map CT-05-105b, F1, Volume 2, CFA24 Map Book); and
- be managed from Birmingham Interchange station main compound (see Figure 8).

2.3.41 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- utility diversions;
- temporary alternative routeing of Footpath M96;
- construction of the retaining walls associated with the widening of Stonebridge Island;
- earthworks associated with the road widening of Stonebridge Island;
- Stonebridge Island junction improvements; and
- reinstatement, planting and landscaping.

2.3.42 Western Power high-voltage overhead power line will be permanently diverted underground for approximately 900m to the south of Stonebridge Island. See Volume 1, Section 6.5 for a description of the utilities construction technique that will be adopted. There are other utility diversions that are associated with the works being undertaken to Stonebridge Island, which will be managed from different compounds (see sections on A45/A45 Service Road overbridges, East Way Loop underbridge, A45/East Way overbridges and A452/A446 roundabout satellite compounds for details of these diversions).

2.3.43 A temporary alternative route of Footpath M96 will be provided adjacent to the A452 Chester Road, east of its current alignment, adding an additional 50m. Footpath M96 will be reinstated along its existing alignment upon completion of the drainage works associated with the A452 Chester Road.

2.3.44 This compound will be used to manage all works associated with improvements, including widening and construction of a retaining wall, to Stonebridge Island which will require traffic management. Due to the traffic management requirement, some works will need to be undertaken outside of core construction hours as defined in the draft CoCP. Construction will take approximately one year and three months to

complete. See Volume 1, Section 6.10 for a description of road diversion activities during construction that will be adopted.

2.3.45 No demolitions of buildings will be required.

2.3.46 No realignments of watercourses will be required.

2.3.47 Finalisation works will include reinstatement, landscaping, planting and highway finishes including road markings, traffic signals, safety barriers and street lighting.

A45/A45 Service Road overbridges; East Way underbridge Loop and A45/East Way overbridges satellite compounds

2.3.48 These three compounds (see Map CT-05-105b, E5 and E6, C5 and C8, Volume 2, CFA24 Map Book) will provide for civil engineering works predominantly for the construction of the A45 Coventry Road, East Way, and A45 Service Road overbridges, and the East Way Loop underbridge, earthworks and highway works. The compounds will:

- be operational for approximately four years and nine months, commencing in approximately 2017;
- support up to approximately 25 workers per compound each day throughout much of this period;
- not provide worker accommodation;
- be primarily accessed from either the A45 Service Road or the East Way, although some construction traffic will use the private access from Diddington Lane. Haul roads will be constructed on each side of the A45 Coventry Road. The haul road on the south-east side of the A45 Coventry Road will connect the A45 Service Road overbridge satellite compound with the A45 Service Road and other satellite compounds in the Balsall Common and Hampton Road area (CFA23). Haul roads accessed from the East Way will connect the other compounds with the main compound site. As the haul road will be unable to cross the A45 Coventry Road, a roadhead will be provided on the north and south sides of the A45 Coventry Road with areas of temporary materials stockpile (see Map CT-05-105b, A8 and B8, D6 and E6, Volume 2, CFA24 Map Book);
- provide temporary materials stockpile adjacent to the A45/A45 Service Road overbridges satellite compound; (see Map CT-05-105b, D5, D6, E5 and E6, Volume 2, CFA24 Map Book); and
- be managed from Birmingham Interchange station main compound (see Figure 8).

2.3.49 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- building demolition;

- construction of Pasture Farm accommodation overbridge (in Balsall Common and Hampton-in-Arden (CFA 23));
- permanent realignment of the Pasture Farm access track;
- realignment of an unnamed watercourse;
- permanent realignment National Motorcycle Museum access;
- permanent realignment of the Bickenhill Waste Recycling Centre access;
- permanent realignment of Footpath M107;
- temporary alternative route of Footpath M114 in Balsall Common and Hampton-in-Arden (CFA23);
- excavation of Diddington cutting (see Map CT-05-105b, D6 and E6, Volume 2, CFA24 Map Book) and the A45 Coventry Road;
- construction of the A45 Coventry Road overbridge, A45 Service Road and East Way overbridges;
- construction of the East Way Loop underbridge;
- utility diversions (to be diverted through the new bridges on completion of each phase);
- drainage and highway works (phased as part the above works); and
- reinstatement, planting and landscaping.

2.3.50 Demolition will be required at two properties. See Volume 1, Section 6.7 for a description of site clearance, enabling works and site mobilisation technique that will be adopted. The two properties to be demolished are at the same geographic location and are:

- commercial property (Top Hat and Tails), A45 Coventry Road; and
- residential property (Nursery Cottage), A45 Coventry Road.

2.3.51 The A45 / A45 Service Road overbridges satellite compound will be used to manage the construction of Pasture Farm accommodation overbridge and Pasture Farm access track. Pasture Farm is located in Balsall Common and Hampton-in-Arden area (CFA23). This overbridge will span approximately 29m and will be approximately 10m in height above rail level. Construction will take approximately one year to complete.

2.3.52 A permanent diversion of an unnamed watercourse of approximately 300m around the A45 Coventry Road and associated earthworks will be required. See Volume 1, Section 6.9, for a description of the drainage and watercourse realignment construction technique that will be adopted.

2.3.53 The existing access to the National Motorcycle Museum will be closed and a new access, approximately 400m east of the existing access, off the A45 Service Road (westbound) will be provided (Map CT-05-106-L1, J2, Volume 2, CFA24 Map Book)

See Volume 1, Section 6.10 for a description of road diversion activities that will be adopted during construction.

2.3.54 The existing access to the Bickenhill Waste Recycling Centre will be closed and a new access, approximately in the position of the existing access, off the A45 Service Road (westbound) will be provided (Map CT-05-105b, D7, Volume 2, CFA24 Map Book). See Volume 1, Section 6.10 for a description of road diversion activities that will be adopted during construction.

2.3.55 A temporary alternative route of Footpath M114 will be required for a period of approximately six months. This alternative route will be approximately 350m via Diddington Lane and Pasture Farm private access, which will add an additional 150m. The majority of the temporary alternative route of Footpath M114 is in Balsall Common and Hampton-in-Arden (CFA23), however the works will be undertaken from the A45 Service Road overbridges satellite compound.

2.3.56 Footpath M107 will be permanently diverted for approximately 200m to the east of the new access for the National Motorcycle Museum.

2.3.57 Construction of the three overbridges and one underbridge will take approximately three years and six months to complete. See Volume 1, Section 5.10 and 6.17 for a description of typical bridges and for associated construction techniques. The majority of works to the A45 Coventry Road and associated service roads will be undertaken during core working hours with some adjacent and tie-in works to the existing carriageway taking place outside of core working hours.

2.3.58 During the construction of the A45 Coventry Road overbridge, a local diversion of the existing A45 Coventry Road traffic northwards to enable the southern section of the A45 Coventry Road overbridge will be required. Once the southern section of the A45 Coventry Road overbridge is built, a local temporary diversion of the existing A45 Coventry Road traffic southwards onto the southern section of the A45 Coventry Road overbridge will be required to enable construction of the northern section of the A45 Coventry Road overbridge. Once the northern section of the A45 Coventry Road overbridge is completed, traffic will be diverted onto the new overbridges.

2.3.59 A vehicle recovery compound west of the East Way Loop underbridge will be provided for the removal of broken down vehicles to minimise disruption to traffic during the works to the A45 Coventry Road and associated service roads (see Map CT-05-105b,C9, Volume 2, CFA24 Map Book).

2.3.60 Earthworks for the Diddington cutting will take approximately one year and nine months to complete. The cutting will be trimmed to profile and then covered with topsoil. See Volume 1, Section 5.2 for description of a typical cutting and Section 6.8 for associated construction techniques. Material for the Diddington cutting will be received from neighbouring CFAs and locally within the Birmingham Interchange and Chelmsley Wood area.

2.3.61 Diversion of two known utilities will be required in advance of the realignment of Pasture Farm private access. See Volume 1, Section 6.5 for a description of the utilities construction technique that will be adopted. The two utility diversions are:

- permanent underground diversion of telecommunications overhead lines commencing at the intersection of the A45 Service Road and the new Pasture Farm access track, along the existing access track southwards along Diddington Lane; and
- permanent underground diversion of a Western Power high-voltage overhead power line for approximately 900m to the south of Stonebridge Island.

2.3.62 Diversion of six known utilities will be required for the A45 Coventry Road and associated service roads, these are:

- permanent diversion of a Western Power high-voltage underground power cables, for approximately 800m, south of the A45 Coventry Road;
- permanent diversion of a Western Power high-voltage underground power cables for approximately 900m, north of the A45 Coventry Road;
- permanent diversion of high-voltage electricity underground power cables for approximately 600m, south of the A45 Coventry Road;
- permanent diversion of a 380mm diameter water main for approximately700m, south of the A45 Coventry Road;
- permanent diversion of a 330mm diameter gas main for approximately 700m, south of the A45 Coventry Road; and
- permanent diversion of telecommunications underground lines for approximately 600m, north of the A45 Coventry Road.

2.3.63 Finalisation works will include reinstatement, landscaping and mitigation planting.

A45/M42 junction 6 roundabout satellite compound

2.3.64 This compound (see Map CT-05-106-L1, H5, Volume 2, CFA24 Map Book) will provide for civil engineering works predominantly to the M42 junction 6 roundabout. The compound will:

- be operational for approximately one year and three months, commencing in approximately 2017;
- support approximately 55 workers each day throughout much of this period;
- not provide worker accommodation;
- be accessed via the A45 Coventry Road roundabout off the M42 northbound carriageway;
- provide an area of temporary materials stockpile and traffic management equipment adjacent to the compound (see Map-CT-05-106-L1, H5 and I5, Volume 2, CFA24 Map Book); and
- be managed from Birmingham Interchange station main compound (see Figure 8).

2.3.65 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- utility diversions;
- temporary alternative routeing of Footpath M107;
- construction of the retaining walls associated with the widening of the M42 junction 6 roundabout;
- earthworks associated with the widening of the M42 junction 6 roundabout;
- road widening of the M42 junction 6 roundabout;
- construction of balancing ponds; and
- reinstatement, planting and landscaping.

2.3.66 No demolition of buildings will be required.

2.3.67 No temporary diversions of highways will be required.

2.3.68 The permanent diversion of two water mains for approximately 700m, diverted either side of the M42 junction 6 roundabout, will be required. See Volume 1, Section 6.5 for a description of the utilities construction technique that will be adopted.

2.3.69 A temporary alternative routeing of Footpath M107, for approximately 200m south of the existing footpath alignment will be required whilst the widening works associated with the M42 junction 6 roundabout are being undertaken (see Map CT-05-106-L1, I6, Volume 2, CFA24 Map Book). The footpath will be reinstated along its existing alignment.

2.3.70 The M42 junction 6 widening and segregated left-turn works will take approximately one year to complete. Works interfacing with highways will be undertaken predominately during core working hours, with some night and weekend working. See Volume 1, Section 6.10 for a description of road diversion construction technique and Section 6.17 for bridge construction techniques.

2.3.71 Two balancing ponds to collect highway run off water, and associated access roads will be constructed. See Volume 1, Section 6.9 for a description of the drainage and watercourse realignment construction technique that will be adopted.

2.3.72 No realignment of watercourses will be required.

2.3.73 Finalisation works will include landscaping, planting and highway furniture.

Birmingham Interchange station car park (east) satellite compound

2.3.74 This compound (see Map CT-05-106, H4, Volume 2, CFA24 Map Book) will provide for civil engineering works predominantly to the Station Exit Link road and the widening and realignment of the A452 Chester Road. The compound will:

- be operational for approximately two years and six months, commencing in approximately 2017;

- support approximately 80 workers each day throughout much of this period;
- not provide worker accommodation;
- be accessed from the A452 Chester Road;
- provide and area of temporary materials stockpile to the north and east (see Map CT-05-`06, F2 and I2, Volume 2, CFA24 Map Book); and
- be managed from Birmingham Interchange station main compound (See Figure 8). Works in this section of the Proposed Scheme will be carried out in the following broad phases:
  - site clearance and enabling works;
  - utility diversions;
  - construction of one culvert;
  - construction of the A452 station exit link underbridge;
  - earthworks associated with the widening of A452 Chester Road;
  - widening and realignment of A452 Chester Road;
  - construction of three balancing ponds; and
  - planting and landscaping.

2.3.75 No demolitions of buildings will be required.

2.3.76 Diversion of several known utilities will be required. See Volume 1, Section 6.5 for a description of the utilities construction technique that will be adopted. The four utilities are:

- permanent underground diversion of a Western Power high-voltage overhead power line for approximately 150m, west of Stonebridge Island.
- permanent diversions of multiple gas mains along the A45 Coventry Road around Stonebridge Island totally approximately 2.5km; and
- permanent diversion of telecommunication underground lines for approximately 600m, north of A45 Coventry Road.

2.3.77 There will be no watercourse realignments required, however, the existing Hollywell Brook underbridge will be removed and replaced with a culvert.

2.3.78 This compound will be used to manage the construction of A452 Chester Road widening and realignment, which will take approximately one year and six months to complete. The access to the Toby Carvery public house and restaurant will be realigned as part of these highway works. See Volume 1, Section 6.10 for a description of road diversion construction techniques.

2.3.79 Temporary widening of the A452 Chester Road will be required to construct the A452 Station Exit Link underbridge in two phases. See Volume 1, Section 5.10 for a

description of typical bridges and Section 6.17 for associated construction techniques that will be adopted.

2.3.80 Earthworks associated with the widening of the A452 Chester Road will take approximately two months to construct. See Volume 1, Section 5.2 for a description of earthworks, and Section 6.8 for associated construction techniques.

2.3.81 Three balancing ponds to collect highway run off water, and associated access roads will be constructed north of the A452 Chester Road. See Volume 1, Section 6.9 for a description of the drainage and watercourse realignment construction technique that will be adopted.

2.3.82 No realignment of footpaths will be required.

2.3.83 Finalisation works will include reinstatement landscaping and planting.

A452/A446 roundabout; M42 motorway viaduct (east); M42 motorway viaduct (west) and M6 junction 4 satellite compounds

2.3.84 These four compounds (see Maps CT-05-106, C5, CT-05-107, H6 and H8; and CT-05-107-R1, F3, Volume 2, CFA24 Map Book) will provide directly the civil engineering works predominantly associated with highway works including the M42 motorway viaduct, A452/A446 roundabout, and M6 junction 4. These compounds will:

- be operational for approximately four years and six months, commencing in 2017;
- support approximately up to 50 workers per compound each day throughout much of this period;
- not provide worker accommodation;
- be accessed from the adjacent highways. The M6 junction 4 satellite compound will be accessed via a short section of haul road from the A446 Stonebridge Road. The M42 motorway viaduct (east) and A452/A446 roundabout satellite compounds will be accessed from the A452 Chester Road. The M42 motorway viaduct (west) compound will be accessed from the B4438 Bickenhill Parkway/Northway. Haul roads will link up the A452/A446 roundabout and M42 motorway viaduct (east) satellite compounds within the Birmingham Interchange site for bulk material movements with areas of temporary material stockpile. A roadhead will be located adjacent to the east of the M42 motorway viaduct (west) satellite compound to provide temporary storage for earthwork materials (see Map CT-05-107, H7 and I7, Volume 2, CFA24 Map Book); and
- provide areas of temporary materials stockpile adjacent to the M42 motorway viaduct (west) satellite compound (see Map CT-05-107, G7 and H8, Volume 2, CFA24 Map Book).

2.3.85 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;

- earthworks associated with the Bickenhill embankment (see: Map CT-05-106, I6, Volume 2, CFA24 Map Book), the Bickenhill cutting (see Map CT-05-106, D6, E6 and F6, Volume 2, CFA24 Map Book),the Packington embankment (see Map CT-05-107, H6, I6 and J6, Volume 2, CFA24 Map Book) and a small section of the Pool Wood embankment (see Maps CT-05-107, E6, F6 and G6, Volume 2, CFA24 Map Book). The construction of Pool Wood embankment is predominantly managed from the Coleshill Heath Road underbridge satellite compound;
- earthworks associated with the A452 southbound on link, A452 /A446 roundabout south overbridge, A452 /A446 roundabout north overbridge and A452 Link Road overbridge;
- construction of the A452 southbound on link, A452 northbound off link, A452/A446 roundabout south overbridge, A452/A446 roundabout north overbridge, and A452 Link Road overbridge;
- temporary alternative routes for Footpaths M104 and M105;
- construction of highway works associated with the A452/A446 roundabout and associated link roads;
- diversion of utilities into or through the new road carriageway and structures;
- widening of the M6 junction 4 roundabout;
- widening of the A446 Stonebridge Road;
- realignment of two watercourses;
- construction of Packington culvert;
- construction of A452/A446 roundabout north and south overbridges;
- construction of A446 southbound off link and A446 northbound on link;
- construction of A452/B4438 roundabout works, and the connecting B4438 Bickenhill Parkway Link, Solihull Parkway and Northway;
- construction of the A452 link road;
- construction of the M42 motorway viaduct;
- the removal of the existing A452 Chester Road roundabout from over the M42 and the existing A452 Link Road from over the A446 Stonebridge Road;
- construction of balancing ponds;
- construction of the auto-transformer station base slab and associated infrastructure, including an access road, to allow the subsequent railway installation works (see Map CT-05-107, J7 Volume 2, CFA24 Map Book); and
- reinstatement, planting and landscaping.

2.3.86 No demolition of buildings will be required.

2.3.87 Material for the Bickenhill embankment will be received locally from Bickenhill cutting and from the excavation works associated with Birmingham Interchange station. Material for the Pool Wood embankment will be received from neighbouring CFAs and locally within the Birmingham Interchange and Chelmsley Wood area.

2.3.88 Diversion of two roads will be required:

- temporary diversion of junction 6 to junction 7 of the M42 for approximately 500m along the existing carriageway, for a period of one year and six months, during the construction of the M42 motorway viaduct; and
- the A452Chester Road/B4438 Bickenhill Parkway roundabout works and the B4438 Bickenhill Parkway Link will require temporary local diversions and widening to tie-in the newly constructed offline highway works to the existing road network. Once completed, the traffic will be permanently realigned onto the new A452 Chester Road/B4438 Bickenhill Parkway roundabout and the B4438 Bickenhill Parkway Link. This temporary diversion will be approximately 1km long and will be for a period of one year and six months.

2.3.89 A separate vehicle recovery compound adjacent to the A452 Chester Road will be provided for the removal of broken down vehicles to minimise disruption to traffic (see Map CT-05-106, D4, Volume 2, CFA24 Map Book).

2.3.90 Temporary alternative routes of two footpaths will be required:

- temporary alternative route for Footpath M105, north of the existing alignment, adjacent to Melbicks Garden and Leisure centre, adding an additional 50m. Footpath M105 will be reinstated along its existing alignment upon completion of the realignment and widening works associated with the A452 Chester Road; and
- temporary alternative route for Footpath M104, adjacent to B4438 Bickenhill Lane, adding an additional 50m. This will be required for the works associated with the people mover construction (See Map CT-05-106-L2, D4, Volume 2, CFA24 Map Book). Footpath M104 will be reinstated along its existing alignment upon completion of people mover construction.

2.3.91 Realignment of two watercourses will be required. See Volume 1, Section 6.9 for a description of the drainage and watercourse realignment construction technique that will be adopted. The two watercourses are:

- permanent realignment of an unnamed watercourse at Denbigh Spinney, 150m north-west of Bickenhill Lane, which will require a realignment of approximately 600m around the A452 /A446 roundabout; and
- permanent realignment of an unnamed watercourse, 120m north-east of East Way, which will require a realignment of approximately 60m under the route.

2.3.92 Diversion of several known utilities will be required. See Volume 1, Section 6.5 for a description of the utilities construction technique that will be adopted. The key utilities are:

- permanent diversion of a National Grid overhead power line for approximately 100m eastwards of the existing alignment. This realignment may require tensioning works to be undertaken to the overhead power line and transmission tower located in Coleshill and Bannerly Pools SSSI, however these works will not be intrusive[21] (see Maps CT-05-107, G5 to J8 and CT-05-106, A6 to C8, Volume 2, CFA24 Map Book);
- a permanent underground diversion of a Western Power high-voltage overhead power line from an existing transmission tower located between Northway and the M42. The diversion will take place along the Northway and then along the Bickenhill Parkway Link road and the A452 Chester Road, before connecting back in with the existing underground supply on the A452 Chester Road (see Map CT-05-107, I8 to E7, Volume 2, CFA24 Map Book);
- permanent underground diversion of an existing Western Power high-voltage overhead power line, for approximately 1.6km, adjacent to the A446 Stonebridge Road and internal station access roads;
- permanent diversion of a 125mm diameter water main for approximately 3km into the A452/A446 roundabout north overbridge; and
- permanent diversion of telecommunications underground cable for approximately 350m into the A452/A446 roundabout north overbridge.

2.3.93 Six balancing ponds to collect railway run off water and four balancing ponds to collect highway run off with associated access roads, will be constructed. See Volume 1, Section 6.9 for a description of the drainage and watercourse realignment construction technique that will be adopted.

2.3.94 Finalisation works will include reinstatement, landscaping and planting.

Coleshill Heath Road underbridge satellite site compound

2.3.95 This compound (see Map CT-05-107-R1, E6 and E6, Volume 2, CFA24 Map Book) will provide for the civil engineering works predominantly associated with the Coleshill Heath Road underbridge, M6 motorway box structure, Pool Wood embankment and associated works. The compound will:

- be operational for approximately two years and six months, commencing in approximately 2019;
- support approximately 25 workers each day throughout much of this period;
- not provide worker accommodation;
- be accessed from Coleshill Heath Road;
- include a temporary materials stockpile area, associated with the construction of the Pool Wood embankment, located in between the M42 and the A452 Chester Road (see Map CT-05-107, E6, Volume 2, CFA24 Map Book).

[21] There are no diversions proposed to the National Grid overhead power line located within the Coleshill and Bannerly Pools SSSI However, if required to undertake maintenance works, National Grid have powers of entry to undertake such works within the SSSI.

Additional linear temporary stockpile areas will be located north-east and south-west of the embankment (see Map CT-05-107-R1, E7 to I9 and E6 to I8) and

- be managed from M6 motorway main compound in Coleshill Junction (CFA19).

2.3.96 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- utility diversions;
- tensioning works to overhead high-voltage power lines;
- construction of M6 motorway box structure. See Volume 1 Section 5.10, for a description of typical bridges, Section 5.9 for a description of typical viaducts and Section 6.17 and 6.16 respectively for associated construction techniques that will be adopted;
- construction of the Pool Wood embankment (see Map CT-05-107-R1, E7to J9, Volume, CFA24 Map Book);
- construction of Coleshill Heath Road underbridge;
- construction of two balancing ponds; and
- reinstatement, planting and landscaping.

2.3.97 No demolitions will be required.

2.3.98 Diversion of a number of known utilities will be required. See Volume 1, Section 6.5 for a description of the utilities construction technique that will be adopted. The key ones being:

- permanent diversion of National Grid overhead power line for approximately 2.2km, near Chelmsley Wood;
- permanent diversion of a Western Power low-voltage underground power line under the existing alignment for approximately 150m, approximately 500m south of Coleshill Heath Road;
- permanent diversion of a Western Power high-voltage overhead power line located to the east side of the route, for approximately 375m, directly south of Coleshill Heath Road;
- permanent relocation of a mobile telecommunications mast, directly south of Coleshill Heath Road on the centre line of the route. A suitable alternative location for the mobile telecommunications mast will be identified within the land required for the Proposed Scheme;
- permanent diversion of a National Grid gas main for approximately 150m, along Coleshill Heath Road, within the new road layout; and

- permanent diversion of a water main for approximately 250m, along Coleshill Heath Road, the diversion will be within the road layout.

2.3.99 The compound will be used to manage the construction of Coleshill Heath Road underbridge (see Map CT-05-107-R1, E7, Volume 2, CFA24 Map Book) and the M6 motorway box structure (see Map CT-05-107-R1, D6, Volume 2, CFA24 Map Book). Construction will take approximately one year and three months for the Pool Wood embankment, one year and three months for Coleshill Heath Road underbridge and one year and nine months to complete construction of the M6 motorway box structure. See Volume 1, Section 5.10 and 6.17 for a description of construction techniques that will be adopted for typical bridges.

2.3.100 The material for the Pool Wood embankment (see Map CT-05-107-R1, E9 to J10, Volume 2 CFA24 Map Book) will be deposited in layers to profiled earthwork slopes and compacted with heavy vibratory plant. Slopes will be covered with topsoil to a predetermined depth and then trimmed to the prescribed profile. See Volume 1, Section 5.2 for a description of a typical embankment and Section 6.8 for associated construction techniques. Material for the Pool Wood embankment will be received from neighbouring CFAs and locally within the Birmingham Interchange and Chelmsley Wood area. Construction of the Pool Wood embankment will take approximately one year and three months to complete.

2.3.101 Coleshill Heath Road will remain open, but will require a temporary online single lane with traffic control for a period of one year to the east of the existing road for approximately 180m.

2.3.102 Two balancing ponds to collect highway run off water, and associated access roads will be constructed, adjacent to the Pool Wood embankment. See Volume 1, Section 6.9 for a description of the drainage and watercourse realignment construction technique that will be adopted.

2.3.103 No realignment of watercourses will be required.

2.3.104 No temporary alternative routes or permanent diversions of ProW will be required.

2.3.105 Finalisation works will include reinstatement, landscaping and planting.

M6 Motorway main compound

2.3.106 This compound is not located within the Birmingham Interchange and Chelmsley Wood area and no works will be directly undertaken from it, but it will provide support to the civil engineering works at Coleshill Heath Road underbridge satellite compound, as illustrated in Figure 8. See Coleshill Junction (CFA19) for more information regarding this compound.

Birmingham Interchange station car park (west) and people mover depot; People mover (M42); People mover Pendigo Lake; People mover NEC station, People mover Birmingham International station; and People mover Birmingham Airport satellite compounds

2.3.107 These six compounds (see Maps CT-05-106, H8; CT-05-106-L1, G5, F3, and CT-05-106-L2, D2, D4 and D6, Volume 2, CFA24 Map Book) will provide for the civil engineering

works predominantly associated with the people mover, the four people mover stops and the people mover depot. These compounds will:

- be operational for approximately three years and six months, commencing in 2019;
- support approximately 55 workers per compound each day throughout much of this period;
- not provide worker accommodation;
- be accessed via the A45 Coventry Road, A452 Chester Road and the NEC road network; and
- be managed from Birmingham Interchange station main compound (see Figure 8).

2.3.108 These compounds will be used to manage the construction of the people mover which will be elevated on viaduct, approximately 2.3km in length, and will take approximately three years to construct. The elevated people mover will cross over the M42, Pendigo Way, Pendigo Lake, the Rugby to Birmingham line and the NEC, before terminating at Birmingham Airport. Four stops will be constructed along the route, at the proposed Birmingham Interchange station, NEC Birmingham International station and Birmingham Airport. The Birmingham Interchange car parks (west) and people mover depot satellite compound will also facilitate the construction of the people mover depot.

2.3.109 Works in this section of the Proposed Scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- utility diversions;
- tensioning works to overhead high-voltage power lines;
- construction of balancing ponds;
- temporary alternative route of a footpath around Pendigo Lake;
- construction of the people mover viaduct;
- earthworks to lower the level of the existing site adjacent to the people mover depot section;
- construction of the people mover depot access road and staff car park;
- construction of the people mover depot consisting of a single-storey steel framed building and train sidings;
- construction of the four people mover stops; and
- installation of the track work, power supply and the train control and telecommunications See Volume 1, Section 5.17 for a description of track work and Section 6.22 for associated construction activities that will be adopted.

2.3.110 A simplified construction sequence for the people mover depot is proposed to be adopted as follows:

- Phase 1: enabling works will be carried out in advance of the main construction works including; site investigation works and statutory utility diversions;
- Phase 2: establishment of the construction compound, haul roads, site clearance and excavation of ground;
- Phase 3: installation of piles, deep excavations for the inspection/drop pits and shallower excavations for the pile caps, ground beams and ground slabs. Excavation to form the basement and construction of ground beams and basement slabs;
- Phase 4: construction of station steel superstructure up to roof level;
- Phase 5: installation of cladding panels to form the exterior walls;
- Phase 6: installation of the roof;
- Phase 7: installation of mechanical, electrical and public health systems;
- Phase 8: internal depot finishes including internal cladding, blockwork walls, windows, doors, flooring, and ceilings;
- Phase 9: external depot works including block paving and bollards; and
- Phase 10: removal of site compound and haul roads.

2.3.111 A simplified construction sequence for the people mover is proposed to be adopted as follows:

- Phase 1: enabling works will be carried out in advance of the main construction works including; site investigation works and statutory utility diversions;
- Phase 2: establishment of the construction compound, haul roads, site clearance and excavation of ground;
- Phase 3: installation of piles, excavations for the pile caps and construction of the pile caps;
- Phase 4: construction of columns and viaduct superstructure;
- Phase 5: construction of four people mover stops;
- Phase 6: installation of mechanical, electrical and power systems;
- Phase 7: internal stop finishes including internal cladding, blockwork walls and canopies;
- Phase 8: external stop works including block paving and bollards;
- Phase 10: removal of site compound and haul roads; and
- Phase 11: installation, testing and commissioning of the people mover.

2.3.112 The majority of the works will be undertaken during core working hours with some adjacent and tie-in works to the existing carriageway, airport and rail crossing works taking place outside of core working hours.

2.3.113 No demolitions will be required.

2.3.114 Diversions of two known utilities will be required. See Volume 1, Section 6.5 for a description of the utilities construction technique that will be adopted. The utilities are:

- permanent underground diversion of a Western Power high-voltage overhead power line to the north-west of M42 junction 6 for approximately 300m (see Map CT-05-106-L1, G5, to E3, Volume 2, CFA24 Map Book). A temporary overhead diversion of approximately 800m will be required to maintain a supply during the construction of the permanent diversion. One temporary transmission tower will be required, but will be removed when the diversion is completed; and
- permanent diversion of a National Grid overhead power line for approximately 800m, which will be raised from its current alignment by approximately 5m to avoid the proposed people mover (see Map CT-05-106-L1, G5, to D1, Volume 2, CFA24 Map Book). A temporary overhead diversion of approximately 800m will be required to maintain a supply during the construction of the permanent diversion. One temporary transmission tower will be required, but will be removed when the diversion is completed.

2.3.115 Two balancing ponds to collect railway run off water and one to collected run-off from the car park with associated access roads will be constructed. See Volume 1, Section 6.9 for a description of the drainage and watercourse realignment construction technique.

2.3.116 An alternative temporary route for one footpath will be required around the southern perimeter of Pendigo Lake, for approximately 450m for a period of three years. The footpath will be reinstated along its existing alignment.

2.3.117 No temporary diversions of highways will be required, however temporary traffic management will be utilised for road crossings and in particular the works to where the people mover crosses the M42.

2.3.118 No realignment of watercourses will be required.

2.3.119 Finalisation works will include reinstatement, landscaping, planting and commissioning of the people mover.

Interchange auto-transformer station satellite compound

2.3.120 This satellite compound (see Map CT-05-107, I7, Volume 2, CFA24 Map Book) will provide directly for the railway systems installation associated with the Birmingham Interchange auto-transformer station. The compound will:

- be operational for approximately one year, commencing in 2022;
- support approximately 25 workers each day throughout this period;

- not provide worker accommodation;
- be accessed via the access route to the Birmingham Interchange auto-transformer station satellite compound; and
- be managed from Kingsbury Road Railhead main compound in Curdworth to Middleton (CFA20).

2.3.121 Key railway systems installation works in this section of the Proposed Scheme will include the installation of the auto-transformer station (see Map CT-05-107, J7, Volume 2, CFA24 Map Book). See Volume 1, Section 5.16 for description of typical power supply features, including auto-transformer stations, and Section 6.23 for associated construction techniques.

Construction waste and material resources

2.3.122 Forecasts of the amount of construction, demolition and excavation waste (CDEW) and waste from worker accommodation waste that will be produced during the construction of the Proposed Scheme in the Birmingham Interchange and Chelmsley Wood area have been prepared and are presented in Volume 5: Appendix WM-001-000.

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

2.3.124 Based on mitigation earthworks design approach adopted for the Proposed Scheme, local excess or shortfall of excavated material within the Birmingham Interchange and Chelmsley Wood area will be managed with the aim of contributing to the overall balancing of excavated material on a route-wide basis. This overall balance of excavated material is presented in Volume 3, Section 14.

2.3.125 The quantity of surplus excavated material originating from the Birmingham Interchange and Chelmsley Wood area that will require off-site disposal to landfill as excavation waste is shown in Table 1. This is the forecast quantity of contaminated excavated material that is chemically unsuitable for re-use within the Proposed Scheme and which will be taken directly from the Birmingham Interchange and Chelmsley Wood area for off-site disposal to either non-hazardous or hazardous landfill. This represents a proportion of the total quantity of surplus excavated material that will require disposal which altogether is reported on a route-wide basis in Volume 3, Section 14.

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

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

2.3.127 The quantities of demolition, construction and worker accommodation site waste that will require off-site disposal to landfill are shown in Table 1.

Table 1: 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	2,563,695	135,875
Demolition	13,360	1,336
Construction	126,587	12,659
Workers accommodation	169	85
TOTAL	2,703,811	149,954

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

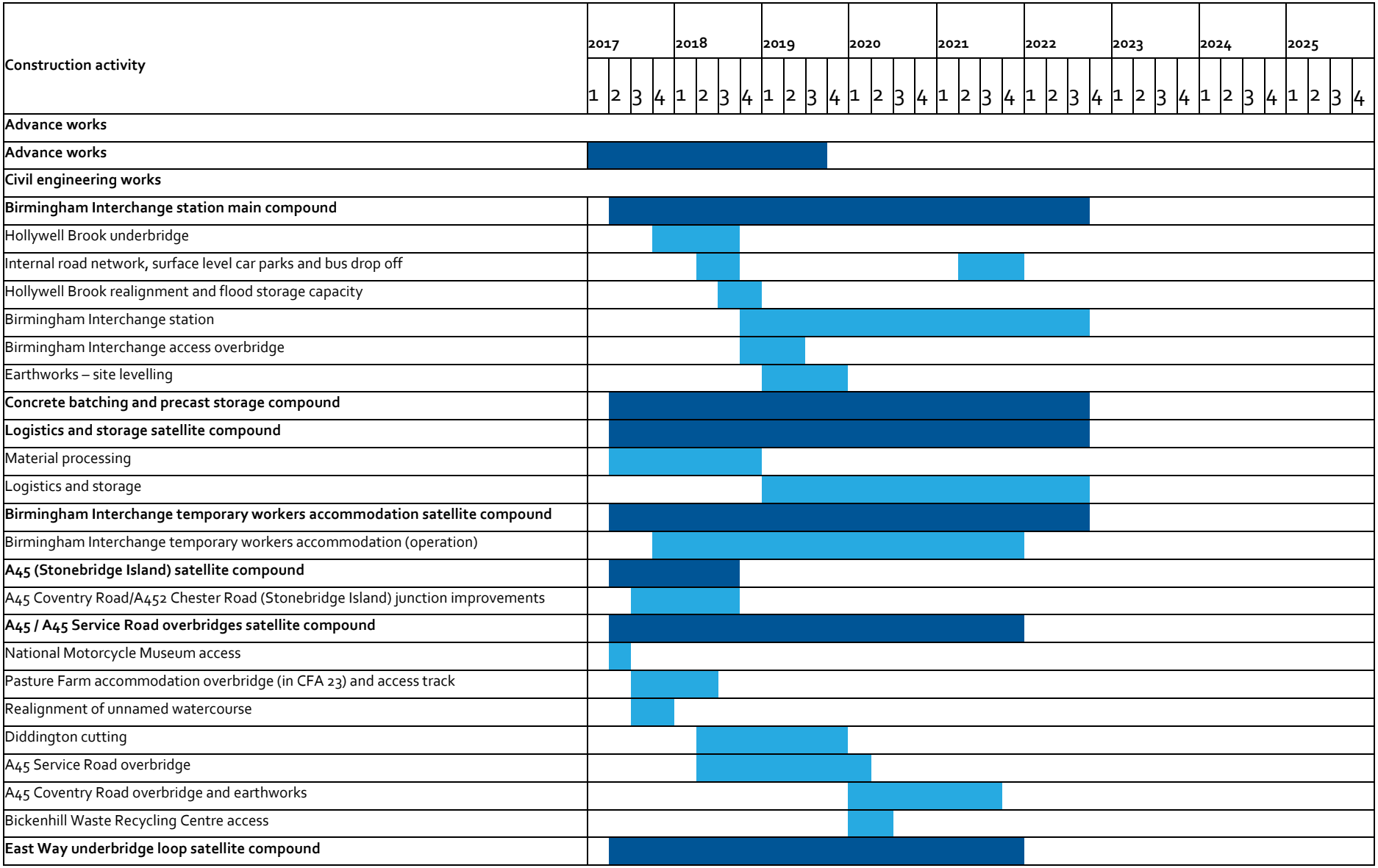
Commissioning of the railway

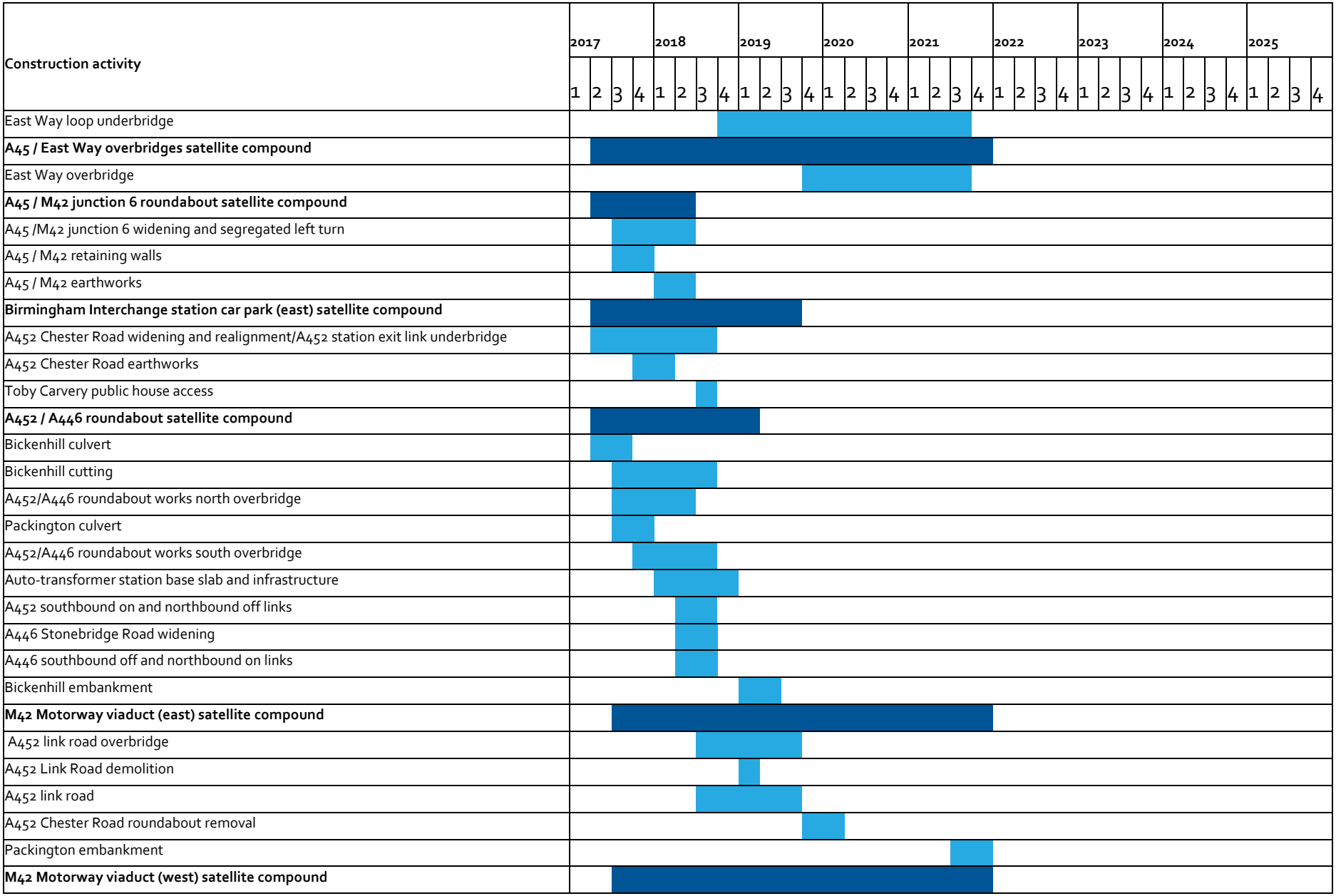
2.3.129 Commissioning is the process of testing the infrastructure to ensure that it operates as expected, and will be carried out in the period prior to opening. Further details are provided in Volume 1, Section 6.26.

Construction programme

2.3.130 A construction programme that illustrates indicative periods for each core construction activity in this area is provided in Figure 11.

Figure 11: Indicative construction programme




Construction activity
2017
2018
2019
2020
2021
2022
2023
2024
2025
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
East Way loop underbridge
A45 / East Way overbridges satellite compound
East Way overbridge
A45 / M42 junction 6 roundabout satellite compound
A45 /M42 junction 6 widening and segregated left turn
A45 / M42 retaining walls
A45 / M42 earthworks
Birmingham Interchange station car park (east) satellite compound
A452 Chester Road widening and realignment/A452 station exit link underbridge
A452 Chester Road earthworks
Toby Carvery public house access
A452 / A446 roundabout satellite compound
Bickenhill culvert
Bickenhill cutting
A452/A446 roundabout works north overbridge
Packington culvert
A452/A446 roundabout works south overbridge
Auto-transformer station base slab and infrastructure
A452 southbound on and northbound off links
A446 Stonebridge Road widening
A446 southbound off and northbound on links
Bickenhill embankment
M42 Motorway viaduct (east) satellite compound
A452 link road overbridge
A452 Link Road demolition
A452 link road
A452 Chester Road roundabout removal
Packington embankment
M42 Motorway viaduct (west) satellite compound

Construction activity	2017				2018				2019				2020				2021				2022				2023				2024				2025			
	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
A452/B4438 roundabout works, B4438 Bickenhill Parkway Link and Solihull Parkway																																				
M42 motorway viaduct																																				
M6 junction 4 satellite compound																																				
M6 junction 4 roundabout widening																																				
Coleshill Heath Road underbridge satellite compound																																				
M6 motorway box structure																																				
Pool Wood embankment																																				
Coleshill Heath Road underbridge																																				
Birmingham Interchange station car park (west) and people mover depot satellite compound																																				
People mover depot , access road and staff car park																																				
Earthworks to lower depot site																																				
Birmingham Interchange people mover stop																																				
People Mover (M42) satellite compound																																				
M42 people mover viaduct crossing																																				
People Mover Pendigo Lake satellite compound																																				
Pendigo Lake people mover viaduct crossing																																				
People Mover NEC station satellite compound																																				
NEC people mover stop and viaduct																																				
People Mover Birmingham International railway station satellite compound																																				
Birmingham International people mover stop and viaduct																																				
People Mover Birmingham airport satellite compound																																				
Birmingham Airport people mover stop and viaduct																																				
Rail infrastructure and systems works																																				
Rail systems installation																																				
Birmingham Interchange station satellite compound																																				
Birmingham Interchange station fit out works																																				
Interchange auto-transformer satellite compound																																				
Birmingham Interchange auto-transformer station installation																																				

Construction activity	2017				2018				2019				2020				2021				2022				2023				2024				2025			
	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
Commissioning																																				
Commissioning (to 2026)																																				

Key

Construction works

Compound duration

2.4 Operation of the proposed scheme

Operational specification

2.4.1 Volume 1, Section 4.1 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 in this area, that with Phase One in place there would be up to 14 trains per hour (tph) in each direction during the peak hours, and that with Phase Two in place the frequency could rise to 19tph. The assessment of sound, noise and vibration has taken into account the frequency during Phase Two.

2.4.3 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. The first passenger trains of the day would leave the Birmingham Interchange no earlier than 05:00 Monday to Saturday (and 08:00 on Sundays) and the last will arrive no later than midnight.

2.4.4 Each train could hold up to 550 people (one-unit train) or 1,100 people (two-unit train). A proportion of the passengers will alight from the trains at the station as their final destination, or alight to transit to other transport services from the station. Trains which stop at Birmingham Interchange station will be accelerating away from or decelerating as they approach the station, potentially reaching the maximum of 360kph east of the station.

2.4.5 Birmingham Interchange station will provide domestic high speed rail travel to the public, with provision for international facilities. Passengers will alight at Birmingham Interchange station for onward travel by other transport services or continue to Curzon Street station or onto the classic rail network at the Delta junction.

2.4.6 The station will accommodate public facilities such as waiting areas, ticket machines, information, public toilets and retail, food and beverage outlets. Ancillary facilities, including accommodation, will be provided for staff.

Maintenance

2.4.7 Volume 1, Section 4.1 describes the maintenance regime for HS2.

2.4.8 The intention is that inspections of the route and people mover will take place on a regular basis, at night when the railway is not operating. There will be preventative maintenance, possibly including grinding and milling of running rails, this will only be required for the people mover if the system technology adopted runs on steel rails. This type of maintenance will be infrequent, probably no more than once every couple of years.

2.4.9 The people mover depot will be capable of being used on a 24 hours a day, seven days a week basis once the Proposed Scheme is operational. However, it is expected that it will only be in use when maintenance is required on people mover rolling stock. The depot can accommodate a maximum core staff of four working full-time although this number may be increased slightly by occasional visitors. The main activities to be undertaken within the depot are:

- internal and external cleaning of rolling stock units, including power washing;
- light and medium maintenance of rolling stock units; and
- maintenance administration.

Operational waste and material resources

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

2.4.11 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.

2.4.12 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.

2.4.13 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.

2.4.14 The quantity of operational waste that will be re-used, 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%.

2.4.15 On this basis, approximately 1,001 tonnes of operational waste will be re-used, recycled and recovered during each year of operation of the Proposed Scheme in the Birmingham Interchange and Chelmsley Wood area. Approximately 412 tonnes will require disposal to landfill (see Table 2).

Table 2: Operational waste forecast for the Proposed Scheme

Waste source	Estimated quantity of waste generated per annum (tonnes)	Estimated quantity of waste for disposal to landfill per annum (tonnes)
Railway station and trains	660	264
Rolling stock maintenance	675	135
Track maintenance	72	11
Ancillary infrastructure	6	2

TOTAL	1,413	412

2.4.16 The assessment of the likely significant environmental impacts and 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:

- 4 April 2012 at the Concourse Hospitality Suites 21 and 22, the NEC;
- 20 June 2012 at Kingshurst Evangelical Church, Chelmsley Wood;
- 11 September 2012 at Kingshurst Evangelical Church, Chelmsley Wood;
- 26 November 2012 at the Loft, Bluebell Centre, Chelmsley Wood;
- 6 March 2013 at the Loft, Bluebell Centre, Chelmsley Wood; and
- 18 September 2013 at the Loft, Bluebell Centre, Chelmsley Wood.

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:

- routing of construction traffic and potential noise and air quality impacts;
- proximity of the route of the Proposed Scheme to Chelmsley Wood;
- severance of Heath Park and Bluebell Recreation Ground;
- loss of open space at Heath Park;
- opportunities for an alternative horizontal alignment or cut-and-cover tunnel for the section of the route of the Proposed Scheme adjacent to Chelmsley Wood;
- noise emitted from the operation of the Proposed Scheme and Birmingham Interchange station and the impact on residents of Chelmsley Wood and Middle Bickenhill;
- electromagnetic impacts generated during the construction and operation of the Proposed Scheme;

- disruption to access to the NEC during and after construction;
- location of the Birmingham Interchange station car park in terms of traffic impacts and the integration of the car parks into the existing landscape;
- land required for the Proposed Scheme from Packington Estate, particularly in relation to the Birmingham Interchange station car parks and the possible prevention of mineral extraction in close proximity to Park Farm; and
- the interface and journey times of the people mover with the NEC, Birmingham International station and Birmingham Airport.

2.5.5 In addition to the 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 the 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. Details were also provided directly to properties within 1km of the Proposed Scheme. In the Birmingham Interchange and Chelmsley Wood area consultations on the draft Environmental Statement and on the Design Refinement were held on 13 June 2013 at the Loft, Bluebell Centre, Chelmsley Wood.

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 to 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 the local area are described in this section.

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

Birmingham Interchange station

2.6.3 The Birmingham Interchange station will be situated within a triangular site, bordered by the M42, the NEC and Birmingham Airport to the west, the A45 Coventry Road to the south and the A452 Chester Road to the east. A review of the vertical alignment has been carried out in response to a request from the community forum for a cut-

and-cover tunnel for the section of the route adjacent to Chelmsley Wood. Options were considered relating to the vertical alignment, each with three sub-options relating to the location of the station. The Proposed Scheme includes the Birmingham Interchange station located to the south of the triangular site with the route passing under the A45 Coventry Road and over the M42. The Birmingham Interchange station concourse will be located over the platforms. Options considered were as follows:

- Option 1: the route alignment would be raised to pass over the A45 Coventry Road as well as the M42. The Birmingham Interchange station concourse would be located beneath the platforms. Sub-options with the station located to the south, centre and north of the triangular site were considered;
- Option 2: the A45 Coventry Road would pass over the route which would then continue in a cut-and-cover tunnel. The Birmingham Interchange station concourse would be located over the platforms. Sub-options of the station located to the south, centre and north of the triangular site were considered;
- Option 3: the route would be in a twin bore tunnel at a maximum depth of 45m below ground level. Platforms would be approximately 35m below ground with the station concourse to be located over the platforms. Sub-options of the station located to the south, centre and north of the triangular site were considered; and
- Option 4: the Proposed Scheme.

2.6.4 In terms of amendments to the vertical alignment Option 1 and 3 were not taken forward due to construction complexity and cost when compared to the Proposed Scheme. With respect to Option 2, the alignment limitations would mean that the route would pass under the M6 and the M42/M6 slip road, resulting in additional construction complexity and temporary realignment of the road network in this area which was not considered favourable. For the location of Birmingham Interchange station, the southern part of the triangular site was considered preferable for siting within the natural topography compared to the alternatives. Further, the connection with the A45 Coventry Road, from which the majority of operation of traffic movements would be generated, is preferred. When compared to the northern station location the Proposed Scheme is likely to result in increased amenity impacts on residents of Middle Bickenhill Lane and has the greater potential for water quality impacts associated with the construction of platforms over Hollywell Brook. As the Proposed Scheme is in the southern part of the triangular site, the crossing of Middle Bickenhill Landfill would be limited and as such, disturbance to the landfill would be reduced.

2.6.5 For these reasons HS2 Ltd decided to adopt Option 4 as the Proposed Scheme.

M42 motorway viaduct

2.6.6 The route crosses over the M42 between junctions 6 and 7 and therefore a bridge structure is required. Currently, two bridges carry a large roundabout on the A452 Chester Road over the M42. As part of the design development process since the announcement of the scheme in January 2012 consideration has been given to the design of this crossing. The Proposed Scheme will cross at approximately the same

level as the existing A452 Chester Road structures, necessitating their demolition and the realignment of the local road network. Options that would involve a complex realignment of the M42 were not investigated as these were considered impractical due to the proximity of motorway junctions and very high traffic flows. The Proposed Scheme comprises a viaduct over the M42. The length of the viaduct will be approximately 215m. Options considered were as follows:

- Option 1: half through girder (steel beams) spanning parallel to the route with skewed abutments[22]. The length of the structure would be approximately 85m;
- Option 2: single-span truss spanning parallel to the route with abutments square to the bridge. Similar to Option 2, the deck would sit between tall trusses. The length of the structure would be approximately 165m. The truss structure would be likely to have an overall depth of in excess of 20m; and
- Option 3: the Proposed Scheme.

2.6.7 When considered against the alternatives, the Proposed Scheme was considered to be the most cost-efficient, will reduce long-term maintenance, and represented the lowest risk in terms of design and construction complexity, particularly in comparison to Option 2 which would require a high skew over the M42. The Proposed Scheme will keep the top of the bridge structure as low as possible. There were no discernible differences between these options with respect to environmental issues.

2.6.8 For these reasons HS2 Ltd decided to adopt Option 3 as the Proposed Scheme.

Hollywell Brook realignment

2.6.9 The Proposed Scheme alignment passes over Hollywell Brook, a tributary of the River Blythe, and therefore a realignment or culverting works is required. As part of the design development process since the announcement of the scheme in January 2012, the design of this realignment has been given further consideration. The Proposed Scheme comprises of a bridge-crossing square to the diverted river. The route will be elevated on three bridges, with a single track bridge for the up loop, a four-track bridge for the central lines, and a single track bridge for the down loop. Hollywell Brook will be diverted beneath the route and beyond the platforms to the south of the Birmingham Interchange station. To the south-west there will be a minor realignment in a new channel prior to re-joining the existing alignment. Options considered were as follows:

- Option 1: diversion of Hollywell Brook crossing the route beneath a viaduct over the A45 Coventry Road, then flowing north-easterly to re-join the existing alignment immediately prior to crossing below the A452 Chester Road;
- Option 2: piped culvert crossing beneath the route. This option would be almost completely on the existing alignment with the culvert as close to the existing channel course as possible;

[22] A half through bridge is where the bridge deck sits within deep girders along each side of the bridge.

- Option 3: as the Proposed Scheme but Hollywell Brook would cross beneath the route in a culvert or box; and
- Option 3b: this is a variation of Option 3 and is the Proposed Scheme.

2.6.10 Given the sensitivity of Hollywell Brook, each of the options considered has the potential to impact on water quality and aquatic habitat, to a greater or lesser degree. Loss of agricultural land and severance are the other key environmental issues.

2.6.11 The Proposed Scheme and Option 3 were considered to offer the greatest benefits when compared to Option 1 and 2 in that the realignment of Hollywell Brook is the shortest distance; and lost marginal and aquatic habitat is offset by creating additional habitat as part of the new channel. Unlike Option 3, the Proposed Scheme reduces shading on Hollywell Brook through gaps in the platforms and therefore minimises effects on aquatic habitat. No temporary realignment of Hollywell Brook during construction would be required for the Proposed Scheme. The Proposed Scheme follows the existing topography more closely than Option 1, with Option 1 resulting in a significant modification to the topography in terms of deep cuttings and a long channel diversion, requiring extensive earthworks. The Proposed Scheme will additionally allow the floodplain to pass beneath the Proposed Scheme and therefore mitigate lost storage volume.

2.6.12 For these reasons HS2 Ltd decided to adopt Option 3b as the Proposed Scheme.

People mover

2.6.13 The people mover provides a connection between Birmingham Interchange station, the NEC, Birmingham International station, and Birmingham Airport. As part of the design development process since the announcement of the scheme in January 2012 the alignment of the people mover has been considered in terms of a number of factors including: the location of Birmingham Interchange station; existing environmental characteristics; and transfer time between the station and the NEC, Birmingham International station, and Birmingham Airport. The Proposed Scheme includes the route passing over Pendigo Lake and over the building between NEC Hall 1 and The Pavilion towards Birmingham Airport. Options considered were as follows:

- Option 1: the route passing through the northern end of the NEC towards Birmingham Airport;
- Option 2: the route passing along the main NEC concourse area and over the building between NEC Hall 1 and The Pavilion towards Birmingham Airport;
- Option 3: the Proposed Scheme. Two route alternatives were considered. The first (as considered in the draft ES) includes a series of curves between the NEC and Birmingham Airport in order to exclude columns within Network Rail operational land and to minimise the impact the car access and car parking. The second (as considered in this ES) reduces the curves associated with the first option and delivers a reduced length of elevated structure, by approximately 145m, which minimises restriction on speed and therefore reduces journey time, by approximately one minute, and reduces the cost of construction. This option requires the people mover stop at the NEC to be

relocated from the Interlink Hall to the open space in front of The Pavillion. This is considered to be an improvement in terms of passenger way-finding, flows and integration with the NEC "streetscape"; and

- Option 4: the route passing through the southern end of the NEC site and following the Network Rail corridor towards Birmingham Airport.

2.6.14 Further to engagement with the NEC, it was determined that Option 1 and 2 would significantly affect the NEC operational requirements and therefore both options were discounted. In addition, Option 2 represents increased complexity in passing over the Rugby to Birmingham line. When compared to the Proposed Scheme Option 4 was not preferable as it would increase journey time of the a people mover, increase complexities involved in construction parallel with the Rugby to Birmingham line and the location of the people mover stop at the NEC would be unfavourable. The Proposed Scheme was further considered to be preferable as it marginally reduces amenity impacts on residents of Middle Bickenhill Lane and reduces the loss of agricultural land and disruption to field patterns.

2.6.15 For these reasons HS2 Ltd decided to adopt Option 3 as the Proposed Scheme.

Chelmsley Wood Curve

2.6.16 The January 2012 announced scheme crosses over the M42 and then threads northwards through the existing major road corridor of the M6, A452 Chester Road, M42 and M6 (Toll) passing Chelmsley Wood and Coleshill. As a result the route will pass within 75m of the residential area of Chelmsley Wood. The alignment considered was determined by the fact that it was the only 'gap' within the transport infrastructure in the area, given the expected elevation of the route at this point. That alignment had significant impacts on the residential area of Chelmsley Wood. Most notably, it would have required the loss of playing fields and open space close to Chelmsley Wood.

2.6.17 More detailed design work revealed that the route needed to be raised where it crossed the M42, north of junction 6, the M6, its slip roads and at Coleshill Heath Road to provide the clearance necessary to ensure that there was no conflict between the Proposed Scheme, the motorway and the local highway network. The option of tunnelling under the M42 was discounted because the costs were around £1 billion higher than the lowest cost surface option. Similarly, options to cross under the M42 and M6 were discounted.

2.6.18 This meant that near Chelmsley Wood the route would be approximately 10m higher than the scheme announced in 2012, before returning to the same elevation as the January 2012 route near Gilson. This higher elevation past Chelmsley Wood provides opportunities to consider alternative options for the alignment through this area that were not available in January 2012. These are explained below. Options considered were as follows:

- Option A: the January 2012 alignment but at a higher elevation;

- Option B (the Proposed Scheme): moving the route up to 125m eastwards, from the scheme announced in 2012, further away from Chelmsley Wood, crossing over Coleshill Heath Road on its current horizontal alignment;
- Option C: moving the route up to 125m eastwards, from the scheme announced in 2012, further away from Chelmsley Wood, crossing over a lowered Coleshill Heath Road, requiring a new horizontal alignment for Coleshill Heath Road and requiring modifications to the junction with Yorkminster Drive; and
- Option D: moving the route up to 225m eastwards, further away from Chelmsley Wood and closer to the River Cole.

2.6.19 Option A would potentially increase noise and would increase visual intrusion in Yorkminster Drive, Bluebell Drive and Lyecroft Avenue on the east side of Chelmsley Wood. It would also require the diversion of a fuel pipeline. The raise to the alignment would mean that Coleshill Heath Road would have to pass over the Proposed Scheme at such a high level that it could no longer tie in with the adjacent highway network. This route alignment would also result in the loss of some local parkland, playing fields and play areas.

2.6.20 Option B will reduce amenity impacts on the east side of Chelmsley Wood. The Proposed Scheme will be further away from the residential area of Chemsley Wood than the existing M6 and reduce the impacts on the playing fields and parkland. It will need to be up to 12m above existing ground level. Overall, there will be a small reduction in the sound and visual intrusion to the eastern part of Chelmsley Wood compared with the modified January 2012 route, as described previously. The Proposed Scheme will also no longer require the diversion of the fuel pipeline. HS2 Ltd is committed to reaching an agreement with the local authority relating to the loss of open space during construction and operation. Measures to investigate further are:

- to mitigate the construction effect, the reconfiguration of the existing playing pitch layout at Bluebell Recreation Ground to provide an additional senior playing pitch and improvements to the pedestrian access to Heath Park and Bluebell Recreation Ground; and
- to mitigate the operation effect, the provision of compensation public open space off Coleshill Heath Road, with improved pedestrian access.

2.6.21 Option C would require a new horizontal alignment for Coleshill Heath Road and its junction with Yorkminster Drive. This would have significant impacts on the east side of Chelmsley Wood. Although the Proposed Scheme would be further away from the residential area of Chelmsley Wood than the existing M6, the modified highway would have had a greater impact on the playing fields and parkland. It would have needed to be up to 10m above existing ground level. Overall, there would also be a small reduction in the sound and visual intrusion to the eastern part of Chelmsley Wood compared to the modified January 2012 route, as described previously. Option C would also require the diversion of the fuel pipeline and both Coleshill Heath Road and Yorkminster Drive would need to be lowered locally.

2.6.22 Option D would have introduced significant additional construction complexities arising from crossing the M42 and the River Cole. It would have consequently involved additional costs as well as significant changes to the track layout of Birmingham Interchange station and the Delta Junction. Whilst with this option there could be a reduction in sound, there is likely to be a higher visual intrusion to the Chelmsley Wood residents than the options to move 125m away, which do not have the same complications.

2.6.23 The need to raise the Proposed Scheme in this area in order to provide the necessary clearance over the M42 and Coleshill Heath Road, allows an option to move the Proposed Scheme eastwards, further away from Chelmsley Wood, with the route crossing Coleshill Heath Road at its existing location. A move of 125m to the east reduces the local noise effects and reduces the amount of local parkland, playing fields and play areas taken. The cost and complexity of moving the route further away from Chelmsley Wood is not justified.

2.6.24 For these reasons HS2 Ltd decided to adopt Option B as the Proposed Scheme.

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.

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 assessment (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 assessment (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. Key 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 this CFA, are contained in Volume 5: Appendix AG-001-024.

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 section follows the standard assessment methodology.

3.2.2 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 this study 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 (see Section 9). The arterial drainage[23] in this area is provided by the River Blythe and related minor tributaries, notably the Hollywell Brook, whose floodplains are associated with land generally below 80m above Ordnance Datum (AOD).

3.3.3 The remainder of the study area comprises gently sloping land, with slightly higher ground to the west of the River Blythe with the highest points in the vicinity of Diddington Hill and the A45 Coventry Road in the south and the A452 Chester Road crossing of the M42 at approximately 100m AOD. The shallow valley of the Hollywell Brook runs between these higher areas. Lower land in the north of the study area is associated with the River Cole.

Geology and soil parent materials

3.3.4 The main geological features are described in land quality (see Section 8). The predominant underlying geology mapped by the British Geological Survey (BGS) is Triassic mudstones (Mercia Mudstone Group) (see Map WR-02-024, Volume 5, Map Book Water resources). To the north of the Hollywell Brook and on small areas straddling the A45 Coventry Road, these are overlain by superficial deposits of glacial sands and gravels. The floodplains of the Hollywell Brook and River Blythe have associated alluvial deposits.

Description and distribution of soil types

3.3.5 The characteristics of the soils are described by the Soil Survey of England and Wales[24] and shown on the National Soil Map[25]. The soils are grouped into associations of a range of soil types. They are described in more detail in Volume 5: Appendix AG-001-024 and their distribution is shown on Map AG-02-024 (Volume 5, Map Book Agriculture, forestry and soils).

3.3.6 Across most of the area, the Soil Survey of England and Wales maps show the Arrow association, which is a typically coarse sandy loam soil. These are of variable permeability and occasionally seasonally waterlogged. They are most commonly

[23] Arterial drainage is a drainage system where a number of watercourses flow collectively into one main channel.
[24] Soil Survey of England and Wales (1984), *Soils and their Use in Midland and Western England*, Harpenden: Soil Survey of England and Wales, Bulletin no.12.
[25] Cranfield University (2001), *The National Soil Map of England and Wales* 1:250,000 scale, National Soil Resources Institute, Cranfield University, UK.

assessed as being of Wetness Class[26] (WC) II-III. The extent of these soils is largely determined by the occurrence of superficial Glaciofluvial sands and gravels.

3.3.7 At the southern end of the study area in the vicinity of the A45 Coventry Road is part of an extensive occurrence of the Brockhurst 1 associations. These have heavier textured, clay loam topsoils, over slowly permeable clay subsoils. This reflects their association with the underlying mudstone parent materials. These soils are generally attributed to WC III-IV.

3.3.8 At the northern end of the study area near Chelmsley Wood, is a small area of Salop association which are associated with a discrete presence of an area of glaciolacustrine clays and silts. Salop association comprise clay loam and clay topsoils with slowly permeable subsoils, and fall within WC III-IV.

3.3.9 Fladbury 1 association, related to the floodplain of the River Blythe and Hollywell Brook, are slowly permeable soils with medium or heavy clay loam topsoils over clay subsoils derived from alluvial deposits. They are subject to groundwater waterlogging associated with fluctuating river levels and perennial flooding, and fall within WC IV.

Soil and land use interactions

Agricultural land quality

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

3.3.11 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 area which are: the better draining, lighter soils on superficial sand and gravel deposits of the Arrow association; generally heavier textured soils with slowly permeable substrates of the Brockhurst 1 and Salop associations; and poorly drained clayey soils on the alluvial floodplain of the Fladbury 1 association.

3.3.12 Climate in the area does not in itself place any limitations upon land quality, but the interactions of climate with soil characteristics are important in determining the soil wetness and droughtiness limitations of land. With a combination of moderate annual rainfall and temperatures, the local climate restricts the land to no better than Grade 2 (see Volume 5: Appendix AG-001-024). The resulting number of Field Capacity Days[27] is around 159, which is greater than the average for lowland England (150 days) and is considered to be only slightly unfavourable for providing opportunities for land works.

3.3.13 Gradients and changing slopes are not limiting to agricultural machinery in this area. Flooding in the floodplain of the River Blythe in terms of its extent, duration, frequency and timing is considered to be a potentially limiting factor, with floodplain

[26] Soil wetness is classified according to the depth and duration of waterlogging in the soil profile. Six classes of soil wetness are defined covering a range from soils which are rarely wet close to the surface (WC 1) to those which are almost continuously wet (WC VI).
[27] Field Capacity Day is a meteorological parameter which estimates the duration of the period when the soil moisture deficit is zero. Soils usually return to field capacity (zero deficit) during the autumn or early winter and the field capacity period, measured in days, ends in the spring when evapotranspiration exceeds rainfall and a moisture deficit begins to accumulate and opportunities for mechanised fieldwork are then possible.

soils (Fladbury 1 association) largely falling within Subgrade 3b, with possible small areas of Grade 4.

3.3.14 The principal limiting factors determining agricultural land quality in this area are soil wetness and soil droughtiness. Overall, under the local climatic conditions, the Arrow and better drained Salop association soils are limited to Grade 2 and Subgrade 3a by droughtiness and are shown on Maps AG-01-053 to AG-01-054a (Volume 5, Map Book Agriculture, forestry and soils). The heavier textured Brockhurst 1 and Salop association soils experience seasonal waterlogging and are subject to wetness limitations which place them in either Subgrade 3a or 3b dependent upon their specific topsoil texture.

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

Other soil interactions

3.3.16 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 Soils Strategy for England[29] and The Natural Choice: securing the value of nature[30] and include:

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

3.3.17 Forestry resources represent a potentially multifunctional source of productive timber, landscape amenity, biodiversity and carbon storage capacity. The ecological value and sensitivity of the resources are assessed in Ecology, (see Section 7). Woodland within the area is associated with a variety of soil conditions, with some on naturally occurring soils of the Arrow association and others on disturbed soils related to modern highway works and earlier railway works.

3.3.18 The floodplains of the River Blythe and Hollywell Brook represent the functional flood environment, as set out in the Water resources and flood risk assessment (see Section 13). Flood Zone mapping[31] available from the Environment Agency shows there to be a significant risk of flooding within this area. The River Blythe and its tributary,

[28] Defra (2005), *Likelihood of Best and Most Versatile Agricultural Land.*
[29] Defra (2009), *Soil Strategy for England and Wales.*
[30] Defra (2011), *The Natural Choice: securing the value of nature.*
[31] Environment Agency: http://www.environment-agency.gov.uk; Accessed: 20 December 2012.

Hollywell Brook, also support nature conservation interests. The ecological functions are identified in Ecology (see Section 7).

3.3.19 The presence of soil-borne cultural assets is detailed in cultural heritage (Section 6). The majority of the occupation of the area relates to the post-medieval and later periods. This is reflected in the presence of a range of physical assets and earth work features such as boundary banks and ridge and furrow.

Land use

Land use description

3.3.20 Agricultural land in the study area is predominantly in arable use, except for an area of grassland located between Middle Bickenhill Lane and the M42.

3.3.21 A number of environmental designations potentially influence land use within the study area. All the agricultural land in the 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 Environment 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 farmland. Holdings which have land entered into an agri-environment scheme are identified in Table 3.

3.3.22 Substantial forestry resources adjoin the M42 to the north of where it is crossed by the A452 Chester Road. The majority of these resources are contained within the Coleshill and Bannerly Pools Site of Special Scientific Interest (SSSI), which is discussed further in ecology (see Section 7). Similar smaller areas of woodland are present in the study area including Siding Wood, associated with the alignment of the dismantled Hampton-in-Arden to Shustoke line, and Hollywell Brook. Woodland is relatively well represented covering 10% of land which compares with the national average of 10%.

Number, type and size of holdings

3.3.23 There are seven farms operating in the study area as set out in Table 3. There is a mixture of owner-occupation and tenancies. The extensive presence of tenanted land reflects the land ownership of the two large estates of Packington and Coleshill. The boundaries of the holdings are shown on Maps AG-01-053 to AG-01-54a (Volume 5, Map Book Agriculture, forestry and soils) along with the location of the main farm buildings.

3.3.24 Table 3 sets out the sensitivity of individual farm 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 farm holdings have a greater capacity to change enterprise mix and scale, can better absorb impacts and are less sensitive. Units that rely on the use of buildings (such as intensive livestock and dairy farms, and horticultural units) are less able to accommodate change and have a higher sensitivity. Smaller (less intensively used) units, such as pony paddocks associated with residential properties, have a low sensitivity.

3.3.25 One holding, Home Farm, Hampton-in-Arden, CFA23/16, has land affected by the Proposed Scheme in this area, but the majority of the effects are experienced in the adjoining Balsall Common and Hampton-in-Arden area (CFA23). Another holding, Wheeley Moor Farm, Coleshill CFA19/1, has a larger subsidiary unit, Common Farm CFA24/4, within the area, but also experiences effects of the Proposed Scheme in the adjoining Coleshill Junction area (CFA19). In both these cases, the combined effects are reported in that area which is where the main holding and farm centre are located.

3.3.26 Of the affected holdings, information has not been secured from three. For the purposes of this assessment a judgement has been made, predominantly based on Rural Payments Agency data[32] and observational data, as to the size of the holding.

Table 3: Summary characteristics of holdings

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA 23/16 Home Farm, Hampton-in-Arden	Arable and livestock	324	Farmhouse Bed and Breakfast	None	Medium
CFA24/1 Home Farm, Packington	Arable and livestock	485	None	ELS	Medium
CFA24/2 Park Farm	Arable	324	Not known	ELS	Medium
CFA24/3* Land west of Middle Bickenhill Lane	Livestock	Not known - assessed as at least 50	Not known	Not known	Medium
CFA24/4 Common Farm, part of Wheeley Moor Farm (CFA19/1)	Arable and livestock	150	Livery, kennels, lorry and caravan parking, and car boot sales	ELS	Medium
CFA24/5* Bogs Farm West	Arable	Not known - assessed as at least 50	Not known	Not known	Medium
CFA24/6* Brickfield Farm, part of Hawkeswell Farm	Arable and livestock	Not known - assessed as at least 175	Not known	Not known	Medium

* No Farm Impact Assessment interview conducted; data estimated

[32] Rural Payments Agency; http://www.rpa.defra.gov.uk; Accessed June 2013

Future baseline

Construction (2017)

3.3.27 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. No committed developments have been identified in this area that will materially alter the baseline conditions in 2017 for agriculture, forestry and soils.

3.3.28 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)

3.3.29 No additional committed developments have been identified in this local 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 Proposed Scheme design, the following measures have been incorporated to avoid or mitigate impacts on agriculture, forestry or soils during construction:

- replacement agricultural access, off the A452 Chester Road at Stonebridge Island, to Park Farm (CFA24/2);
- reducing the land take to avoid the loss of buildings at Park Farm (CFA24/2);
- design of access to balancing ponds, adjacent to the A452 Chester Road, to enable joint use as agricultural accesses to replace lost field accesses associated with Home Farm (CFA24/1); and
- a new agricultural access off Coleshill Heath Road at Brickfield Farm (CFA24/6) to access severed land.

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 for the Proposed Scheme 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, for example those of the Brockhurst 1 association, 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):

- 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 pay due consideration to the impacts of extreme weather events and related conditions which may affect agriculture, forestry and soil resources during construction (draft CoCP, Section 5);
- arrangements for the maintenance of farm and field accesses affected by construction, where reasonably practicable (draft CoCP, Section 6);
- the protection and maintenance of existing land drainage and livestock water supply systems, where reasonably practicable (draft CoCP, Section 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 on the land on which permanent works will be sited, but also on the land used temporarily to facilitate the construction delivery of those permanent works.

3.4.6 The land required for the Proposed Scheme and 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 interruption of access and effective use of residual parcels of land. There may also be the loss of, or disruption to, buildings and operational infrastructure, such as drainage. The Proposed Scheme design seeks, however, to minimise this structural disruption[33], and to incorporate inaccessible severed land as part of environmental mitigation works.

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 period of five years of managed aftercare to ensure stabilisation of the soil structure, where appropriate.

Temporary effects during construction

Impacts on agricultural land

3.4.8 During the construction phase, the total area of agricultural land used will be 176.2ha as shown in Table 4. Of this total, 83.2ha will be restored and available for agricultural use following construction.

Table 4: Agricultural land required for the construction of the Proposed Scheme

	Area required (ha)	Percentage of agricultural land	Area to be restored (ha)
Grade 1	0	0	0
Grade 2	12.1	7	7.7
Subgrade 3a	116.4	66	40.9
BMV subtotal	128.5	73	48.6
Subgrade 3b	47.7	27	34.6
Grade 4	0	0	0
Grade 5	0	0	0
Total agricultural land	176.2	100	83.2

3.4.9 The disturbance during construction to 128.5ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% of the overall agricultural land requirement in this area. Although 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.

3.4.10 Following construction the land required temporarily will be primarily reinstated to its pre-existing agricultural condition. Topsoil and subsoil material arising from the Proposed Scheme and permanently displaced will be incorporated in the Proposed Scheme design either within the area or elsewhere along the route, subject to the soil movement plans that will be prepared during the detailed design stage.

[33] Structural disruption is disruption to existing structure of farm holdings principally from severance and the loss of key farm infrastructure.

Nature of the soil to be disturbed

3.4.11 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.

3.4.12 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[34]. These principles will be followed throughout the construction period. The predominant Arrow association soils have textures which renders them generally amenable to safe handling. The heavier textured Fladbury 1, Brockhurst 1 and Salop association soils are, however, less able to remain structurally stable if moved contrary to the guidance in wet conditions or by inappropriate handling equipment. They are susceptible to compaction and smearing which could impede successful reinstatement, and would require remedial action to re-establish a stable structure.

Impacts on holdings

3.4.13 Land may be required from holdings both permanently and temporarily (i.e. the latter only 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 the individual holding will reduce, but the following assessment focuses on the combined effect during the construction phase. The residual permanent effects are discussed at the end of this section.

3.4.14 The effects of the Proposed Scheme on individual agricultural and related interests are summarised in Table 5. 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 rather than the absolute area of land required. The holding/reference name provides a unique identifier and relates to Maps AG-01-053 to AG-01-54a (Volume 5, Map Book Agriculture, forestry and soils) and Volume 5: Appendix AG-001-024.

3.4.15 The effects of temporary severance during construction are judged on the ease and availability of access to severed land. For the most part these will be the same during and post 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-001-024. Where the total sum of the land required by ALC grades differs from the total sum of the land required by holding, the difference is because some holdings are affected in more than one CFA and some

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

holdings include non-agricultural land. The combined impact on holdings is reported once in the CFA where the main holding is located.

Table 5: 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
CFA 23/16 Home Farm, Hampton-in-Arden	2.9ha – 1% Negligible	Negligible	Medium Closure of Diddington Lane – increased operational journeys	Overall assessment made in CFA23	2.5ha
CFA24/1 Home Farm, Packington	8.6ha – 2% Negligible	Low Loss of field accesses	Low Loss of field access – change to operational journeys	Minor	4.4ha
CFA24/2 Park Farm	74.3ha – 23% High	Negligible	Medium Scale of land requirements close to farm centre	Major/moderate	25.0ha
CFA 24/3* Land west of Middle Bickenhill Lane	39.2ha – 78% High	Negligible	Low/medium Scale of land requirements	Major/moderate	22.9ha
CFA24/4 Common Farm, part of Wheeley Moor Farm (CFA19/1)	29.2ha – 20% Medium	Negligible	Medium Scale of land requirements and isolation of subsidiary farm centre	Overall assessment made in Colehsill Junction (CFA19)	16.4ha
CFA24/5* Bogs Farm West	5.7ha – 11% Medium	Negligible	Medium Possible interference with field access	Moderate	0.3ha
CFA24/6* Brickfield Farm, part of Hawkeswell Farm	24.5ha – 14% Medium	Medium Loss of field access	Medium	Major/moderate	16.9ha

*No Farm Impact Assessment interview conducted; data estimated.

3.4.16 Overall, it is considered that four holdings will experience major to moderate temporary adverse effects during construction which are significant, and a further two will experience cumulative effects assessed in the adjoining CFAs where their farm centres are located.

3.4.17 No farm enterprises which are sensitive to noise or vibration emitted during the construction phase, for example intensive poultry houses, have been identified near to the Proposed Scheme. However, diversified activity, including kennels, at Common Farm may potentially be noise sensitive.

Cumulative effects

3.4.18 There are no known cumulative effects arising from the construction of the Proposed Scheme as a consequence of other development projects affecting agricultural land in the locality.

Permanent effects from construction

Impacts on agricultural and forestry land

3.4.19 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

3.4.20 Following construction and restoration, the area of agricultural land that will remain permanently required will be 93.0ha, as shown in Table 6. A further 27.9ha of forestry land will also be permanently affected. The areas in the table refer to agricultural land of a particular grade that is required permanently for the Proposed Scheme, and its proportion of the total area of agricultural land required permanently.

Table 6: Agricultural and forestry land required permanently

	Total area required (ha)	% agricultural land
Grade 1	0	0
Grade 2	4.4	5
Subgrade 3a	75.5	81
BMV subtotal	79.9	86
Subgrade 3b	13.1	14
Grade 4	0	0
Grade 5	0	0
Total agricultural land	93	100
Forestry land	27.9*	

* This figure represents the total area of woodland within the land required to construct the Proposed Scheme. The removal of woodland will be kept to a reasonable minimum to facilitate the construction of the Proposed Scheme, including the retention of woodland within Coleshill and Bannerly Pools SSSI and Denbigh Spinney LWS.

3.4.21 The permanent loss of 79.9ha of land of BMV quality is assessed as an impact of high magnitude, comprising more than 60% of the overall agricultural land requirement. Although BMV land in this local area is a receptor of low sensitivity due to its frequency of occurrence, the permanent effect on BMV land is assessed as a moderate adverse effect of the Proposed Scheme which is significant.

3.4.22 Areas proposed for ecological and landscape mitigation which will be removed from mainstream agricultural production include:

- land adjacent to Siding Wood;
- land adjacent to Hollywell Brook;
- severed parcels of land adjacent to Common Farm (CFA24/4);
- land adjacent to the Proposed Scheme at Brickfield Farm (CFA24/6); and
- land adjacent to Coleshill Heath Road at Brickfield Farm (CFA24/6).

3.4.23 Areas of woodland that will be permanently affected include Brickfield Farm Copse, planting in the vicinity of the A452/A446 roundabout and Hollywell Brook Rough. Overall, the total amount of forestry land within this local area affected to implement the Proposed Scheme will be 27.9ha, out of a total permanent land take of 134.6ha (7.8%). The extent of the forest cover in the study area (10%) is comparable with the average national woodland cover (10%). The quantitative losses will be mitigated by approximately 33ha of new woodland planting and is therefore not significant. This ecological and landscape mitigation is addressed in Ecology and Landscape and visual assessments (see Sections 7 and 9).

Impacts on holdings

3.4.24 The permanent residual effects from the construction of the Proposed Scheme on individual agricultural and related interests is summarised in Table 7. 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. 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-001-024.

Table 7: Summary of permanent effects on holdings from construction

Holding reference/name	**Land required**	**Severance**	**Infrastructure**	**Scale of effects**
CFA 23/16 Home farm, Hampton-in-Arden	0.4ha – 0.1% Negligible	Negligible	Medium Disruption to operational movements from closure of Diddington Lane	Overall assessment of effects made in CFA23
CFA24/1 Home Farm, Packington	4.2ha – 1% Negligible	Negligible	Negligible	Negligible
CFA24/2 Park Farm	49.3ha –15% Medium	Negligible	Medium Disruption due to scale of land requirement	Moderate
CFA24/3*Land west of Middle Bickenhill Lane	16.3ha – 33% High	Low Two residual land areas created	Negligible	Major/moderate
CFA24/4 Common Farm, part of Wheeley Moor Farm (CFA19/1)	12.8ha –8% Low	Medium Two residual land areas created	Medium Isolation of farm buildings and difficult access to severed land	Overall assessment of effects made in CFA19
CFA24/5* Bogs Farm West	5.4ha – 11% Medium	Negligible	Negligible	Moderate
CFA24/6* Brickfield Farm, part of Hawkeswell Farm	7.6ha –4% Low	Negligible	Negligible	Negligible

*No Farm Interview Assessment interview conducted; data estimated.

3.4.25 Overall, it is likely that three holdings will experience major to moderate permanent adverse effects from the construction of the Proposed Scheme which are significant. 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 are able to use compensation payments to replace assets.

Cumulative effects

3.4.26 There are no known permanent cumulative effects arising from the construction of the Proposed Scheme as a consequence of other development projects affecting agricultural land in the locality.

Other mitigation measures

3.4.27 No other mitigation measures are proposed.

Summary of likely significant residual effects

3.4.28 During construction the total area of agricultural land required is 176.2ha, of which 128.5ha is BMV. This is assessed as a moderate adverse residual effect which is significant.

3.4.29 Four holdings will experience temporary major to moderate adverse residual effects which are significant.

3.4.30 Once the construction process is complete and land required temporarily has been restored, the residual permanent requirement for agricultural land will be 93.0ha, of which 79.9ha is BMV. This is assessed as a moderate adverse residual effect which is significant.

3.4.31 A total of three holdings have been identified that will experience permanent major to moderate adverse effects which are significant. These will be likely to remain as agricultural or rural businesses and the use of compensation payments to purchase replacement land or assets could otherwise reduce the severity of the effects.

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. Although in this area, no particularly sensitive agricultural or equestrian receptors have been identified that are close to the Proposed Scheme, diversified activity, including kennels at Common Farm, may potentially be noise sensitive and may require further investigation.

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.

Other mitigation measures

3.5.5 No other mitigation measures are proposed.

Summary of likely significant residual effects

3.5.6 No significant residual effects on agriculture, forestry and soils, with the possible exception of potential noise effects on diversified activity on one holding, 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 (NO2), fine particulate matter (PM10, PM2.5)[35] and dust.

4.1.2 With regards to air quality the main issues are anticipated to result from the emissions of the above air pollutants from construction activities, demolition, site preparations works, as well as the use of haul routes and from road traffic during construction and operation of the Proposed Scheme. This includes the construction and operation of the Birmingham Interchange station, the people mover and people mover depot, construction compounds, concrete batching facility and precast storage area, logistics and storage compound and the storage of temporary material stockpiles.

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

- Volume 5: Appendix AQ-001-024;
- Volume 5: Map AQ-01-024; and
- Volume 5: Map AQ-02-024-01.

4.1.4 Maps showing the location of the key environmental features can be found in the Volume 2, CFA24 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 appendix presented in Volume 5: Appendix AQ-001-024. This report follows the standard assessment methodology.

4.2.2 The study area for the air quality assessment has been determined on the basis of where impacts on air quality may 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)[36]. 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

[35] 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.
[36] Institute of Air Quality Management (2011), *Guidance on the assessment of impacts of construction on air quality and the determination of their significance.*

properties is small, e.g. fewer than 10 properties within 20m of dust-generating activities. Thus, a single property very close to a construction site cannot experience a 'significant effect' as defined by this methodology. The assessment 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 source of existing air pollutants in the Birmingham Interchange and Chelmsley Wood area is traffic on major roads, such as the M6, M42, A45 Coventry Road, A452 Chester Road and A446 Stonebridge Road. Birmingham Airport is also situated within this area to the south-west of the Proposed Scheme. There is one industrial installation within the area, but due to its distance from the Proposed Scheme and the nature of the activities, it is unlikely to have an impact on local air quality (details of this is shown in Volume 5: Appendix AQ-001-024).

4.3.2 Estimates of background air quality have been obtained from the Department for Environment and Rural Affairs (Defra) for 2012 and future years (2017 and 2026)[37]. These data are estimated for 1km grid squares for nitrogen oxides (NOx), NO2, PM10 and PM2.5. Background concentrations are within the air quality standards for all pollutants within the study area.

4.3.3 There are currently three diffusion tube monitoring sites located within the study area for monitoring NO2 concentrations and operated by North Warwickshire Borough Council (NWBC). At these locations, measured concentrations for 2012 were below the air quality standards at two sites, while exceedances of the air quality standard for NO2 were reported at the M6 Coleshill site. Solihull Metropolitan Borough Council (SMBC) also monitored NO2 concentrations at three locations within the study area in 2011, but the monitoring was decommissioned at these sites in 2012. Further details regarding the air quality monitoring are shown in Table 1 of Volume 5: Appendix AQ-001-024.

[37] Defra; 2010 based background maps for NOx, NO2, PM10 and PM2.5; http://laqm.defra.gov.uk/maps/maps2010.html; Accessed July 2013

4.3.4 There are currently no Air Quality Management Areas (AQMAs) within the study area. NWBC had previously declared an AQMA for annual mean NO2 concentrations covering the area around junction 4 of the M6 and a farmhouse to the north. However, due to concentrations reducing below the air quality standard over the past few years and the farmhouse being unoccupied thus removing any relevant exposure, the AQMA was revoked in 2013[38].

4.3.5 Several locations have been identified in the study area as sensitive receptors, which are considered to be susceptible to changes in air quality due to their proximity to dust generating activities and/or traffic routes during construction and operation of the Proposed Scheme. For the construction dust assessment, these receptors are: 217 Old Station Road, properties along Middle Bickenhill Lane, Park Farm, Common Farm and properties along Yorkminster Drive (see Map AQ-02-24-01, Volume 5, Map Book Air quality). For the construction/operational traffic assessments, additional receptors are: Mill Farm, Myrtle Cottage Farm, Bickenhill Stores Cottage, 11 Coventry Road, Elmdon Hall Lodge and properties along Coleshill Heath Road and Drake Croft (see Map AQ-01-024, Volume 5, Map Book Air quality).

4.3.6 There is also one ecological receptor within the study area which is sensitive to dust and nitrogen deposition: the Coleshill and Bannerly Pools Site of Special Scientific Interest (SSSI) which is located near junction 4 of the M6 (see Map EC-01-054a, G3 and H5, Volume 5, Map Book Ecology).

Future baseline

4.3.7 Volume 5: Appendix CT-004-000 identifies 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.

4.3.8 The potential cumulative impact from committed developments on air quality acting in conjunction with the effects from the construction and operation of the Proposed Scheme have been considered as part of this assessment. This has been achieved by including changes in traffic predicted as a result of the committed developments within the traffic data used for the air quality assessments for construction and operation, in which the future air quality baselines are defined as the 'without Proposed Scheme scenarios' at each stage.

Construction (2017)

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

[38] North Warwickshire Borough Council (2013), *Air Quality Progress Report*.

Operation (2026)

4.3.10 Future background pollutant concentrations have been sourced from Defra background maps for 2026, which predict NO2 and PM10 concentrations 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. The draft CoCP 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 (LEMPs) which will set out how the Proposed Scheme 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 and nitrogen deposition.

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 The construction dust assessment was undertaken for the following sensitive receptors due to their proximity to dust generating activities: 217 Old Station Road, Middle Bickenhill Lane, Park Farm, Common Farm, Yorkminster Drive and the Coleshill and Bannerly Pools SSSI. The assessment indicated that there will be a negligible effect at all receptors. As such, the effects of the dust generating activities are not considered significant. Further details on this assessment can be found in Volume 5: Appendix AQ-001-024.

4.4.6 Construction activity can also affect local air quality through the additional traffic generated on the highway network as a result of construction traffic routes and changes to traffic patterns arising from temporary road diversions. The assessment of construction traffic emissions has been undertaken for a without the Proposed Scheme scenario and five scenarios with the Proposed Scheme which represent peak flows during the construction period.

4.4.7 Construction traffic data in the study area has been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2017. The screening identified areas where a quantitative assessment was required. These were predominantly the main roads within the study area, such as the A45 Coventry Road, M42, A452 Chester Road, A446 Stonebridge Road and M6, as well as Middle Bickenhill Lane and Coleshill Heath Road.

4.4.8 The assessment of impacts arising from predicted changes to road traffic emissions along the local road network has concluded that the impact will be negligible for both NO2 and PM10 concentrations. Therefore, the effect on local air quality as a result of the construction of the Proposed Scheme will not be significant.

4.4.9 The assessment of nitrogen deposition for the Coleshill and Bannerly Pools SSSI also concluded that there would be a negligible impact, thus the effect from traffic vehicles during construction of the Proposed Scheme will not be significant.

4.4.10 Further details on these assessments can be found in Volume 5: Appendix AQ-001-024.

Permanent effects

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

Cumulative effects

4.4.12 The assessment has considered the potential cumulative air quality effects of the Proposed Scheme and other committed developments. The traffic data used for the assessment include the traffic changes expected from the committed developments and therefore their impacts have been included within the assessment.

Other mitigation measures

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

Summary of likely significant residual effects

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

4.5 Effects arising from operation

Avoidance and mitigation measures

4.5.1 No mitigation measures are considered to be required 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 and from boiler emissions in the station. 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.

4.5.3 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.

4.5.4 Traffic data in the Birmingham Interchange and Chelmsley Wood area have been screened to identify roads that required further assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2026. The screening identified areas where a quantitative assessment was required. These were along the main roads within the study area, namely the A45 Coventry Road, M42, A452 Chester Road, A446 Stonebridge Road and M6.

4.5.5 The assessment of impacts arising from predicted changes to road traffic emissions along the local road network has concluded that the impact will be slight adverse at worst for NO2 and negligible for PM10 concentrations. Therefore, the effect on local air quality as a result of the operation of the Proposed Scheme will not be significant.

4.5.6 The assessment of nitrogen deposition for the Coleshill and Bannerly Pools SSSI also concluded that there would be a negligible impact, thus the effect from the operation of the Proposed Scheme to the SSSI will not be significant. Further details on these assessments can be found in Volume 5: Appendix AQ-001-024.

4.5.7 Birmingham Interchange station will include a combustion plant to accommodate the heating demand of the buildings. This will include the use of natural gas fired boilers with a proposed total thermal input of 3MW. NO2 emissions from the boilers have been assessed as they will fall under the Clean Air Act[39] requirements. The D1

[39] *Clean Air Act 1993* (c.11). London, Her Majesty's Stationery Office.

methodology[40] has been used to calculate the appropriate height of release for the emissions. The assessment has concluded that a release of emissions from a height of 3m above roof level is appropriate. Since the combustion plant meets all the D1 requirements, the impacts on local air quality are expected to be negligible and the overall effects not significant. Further details on this assessment can be found in Volume 5: Appendix AQ-001-024.

Cumulative effects

4.5.8 The traffic data used for the assessment include the traffic changes expected from the committed developments and therefore their impacts have been included within the assessment.

Other mitigation measures

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

Summary of likely significant residual effects

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

[40] Her Majesty's Inspectorate of Pollution (1993), *Technical Guidance Note (Dispersion) D1: Guidelines on Discharge Stack Heights for Polluting Emissions*. London, Her Majesty's Stationery Office.

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 study area comprise:

- temporary and permanent loss of land and realigned access at the National Motorcycle Museum;
- temporary isolation impact on residents at Middle Bickenhill Lane and the A452 Chester Road;
- permanent loss of the Olympia Motorcycle Track; and
- temporary and permanent loss of public open space at Heath Park and impacts on the amenity of people using Heath Park.

5.1.3 Further details of the community assessments and write-ups of open space surveys and recreational public right of way (PRoW) surveys undertaken within the CFA are contained in Volume 5: Appendix CM-001-024.

5.1.4 Community assessment maps are provided on Maps CM-01-154 to CM-01-155a (Volume 5, Map Book Community).

5.1.5 The current assessment draws upon information gathered from regional and local sources including; Solihull Metropolitan Borough Council (SMBC), the National Motorcycle Museum and the National Exhibition Centre (NEC).

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 Worker accommodation will be located at the Birmingham Interchange temporary workers accommodation satellite compound (see Map CT-05-106-L1, G2, Volume 2, CFA24 Map Book). Construction worker impacts on community resources are considered at a route-wide level in Volume 5: Appendix CM-002-000. The assessment takes into account the number of workers, the type and location of accommodation, working hours, facilities provided at construction compounds, experience from 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 worker accommodation.

5.3 Environmental baseline

Existing baseline

5.3.1 Baseline data on community resources was collected up to 500m 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 required both temporarily and permanently 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 routing of construction traffic and takes account of catchment areas for community facilities which 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 The study area includes land within the suburb of Chelmsley Wood and parts of Bickenhill parish.

Bickenhill

5.3.4 The Bickenhill area is largely dominated by Birmingham Airport and the NEC, and surrounded by the highway network of the M6, M42 and the A45 Coventry Road.

5.3.5 The National Motorcycle Museum is located at the M42 junction 6 and is accessed directly off the A45 Coventry Road/M42 junction 6 roundabout. The access, car park and grassed verge areas within the National Motorcycle Museum site are within areas required for the construction and operation of the Proposed Scheme. The museum provides a range of facilities including training and seminar rooms and hosts major events on a regular basis.

5.3.6 Local recreation facilities include the Olympia Motorcycle Track on Middle Bickenhill Lane, which is within an area of land required for the construction and operation of the Proposed Scheme. The facility provides a recreational and sporting facility with a well maintained, graded motorcross track. The facility is open at weekends and accessible to visitors by paid entry.

5.3.7 Small external areas of the Melbicks Garden and Leisure centre, Toby Carvery public house and restaurant, and the Little Owl public house and restaurant are within areas of land required to construct and operate the Proposed Scheme.

5.3.8 The surrounding area is largely agricultural, with sparse residential properties that are within the parish of Bickenhill. One residential property, Nursery Cottage, located off the A45 Coventry Road, is within an area of land required permanently for the Proposed Scheme. The grounds of Common Farm, on the A452 Chester Road, are partially within an area of land required for the construction of the Proposed Scheme. Other residential properties within the study area are immediately adjacent to areas of land required to construct and operate the Proposed Scheme; these include Park Farm and properties on Middle Bickenhill Lane. These properties are detached and semi-detached in a rural setting.

Chelmsley Wood

5.3.9 Chelmsley Wood, a large residential suburb, is located to the north of Birmingham Airport and the NEC. The estate is well served by local community facilities with a district centre that serves the communities of north Solihull, which is outside of the study area.

5.3.10 Two areas of public open space, Heath Park and Bluebell Recreation Ground, are partially within an area of land required to construct the Proposed Scheme. Heath Park is also within an area required permanently for the operation of the Proposed Scheme.

5.3.11 Heath Park is a triangular area of grassland situated between the M6, Yorkminster Drive and Coleshill Heath Road. The park covers approximately 80,350m^2; approximately 38,000m^2 of which is accessible public open space, the remainder being densely vegetated areas, transmission towers and a landscape bund. Heath Park provides two seasonal senior grassed football pitches and an area of parkland. The Solihull Playing Pitch Strategy[41] assesses the playing pitches at Heath Park as 'good' quality, with capacity for two matches per week. The Strategy reports that an average of one to two matches are currently played at Heath Park per week. Heath Park is also well used by dog walkers (see Heath Park open space survey results in Volume 5: Appendix CM-001-024). An area of Heath Park will be within land required to construct and operate the Proposed Scheme.

5.3.12 Bluebell Recreation Ground covers approximately 71,000m^2 and provides a range of open space and play space including:

- three senior and two mini grassed seasonal football pitches;
- a multi-use games area and skate park at the northern extent;
- a large children's play area in the centre of the site;
- a community garden to the south-west of the recreation ground; and
- a woodland area to the south-east of the recreation ground with a pathway running through it.

5.3.13 The Solihull Playing Pitch Strategy reports that the playing pitches at Bluebell Recreation Ground are overplayed beyond capacity, by five matches per week. The strategy assesses the playing pitches as 'average' quality and describes the recreation ground as a 'key centre'. The strategy recommends that the pitch quality is improved, which would increase the capacity of the site to accommodate current and expected future growth. An area of Bluebell Recreation Ground will be within land required to construct the Proposed Scheme.

[41] Solihull Metropolitan Borough Council (2012), *Final Playing Pitch Strategy*.

Future baseline

Construction (2017)

5.3.14 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. No committed developments have been identified in this area that will materially alter the baseline conditions in 2017 for the community, or that will be significantly affected by the Proposed Scheme from a community perspective.

Operation (2026)

5.3.15 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 minimise the environmental impacts arising during construction:

- the route has been realigned approximately 125m further eastwards from the Chelmsley Wood area to avoid intersecting Bluebell Recreation Ground, to reduce the area of land required at Heath Park and reduce amenity impacts on residential properties;
- the alignment of a diverted high-voltage overhead power line includes the removal of a transmission tower within Heath Park and avoids additional loss of land at Heath Park;
- a satellite compound has been relocated out of Bluebell Recreation Ground to reduce the loss of parkland during the construction of the Proposed Scheme;
- the footprint of the Coleshill Heath Road underbridge satellite compound, located in Heath Park, has been reduced to decrease the loss of open space during the construction of the Proposed Scheme;
- realigned access will be provided to the National Motorcycle Museum, Toby Carvery public house and restaurant, Melbicks Garden and Leisure centre and the Little Owl public house and restaurant; and
- it has been ensured that the areas of land required for the Proposed Scheme avoid residential properties at a number of locations including Middle Bickenhill Lane, Park Farm and Common Farm.

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 minimise nuisance (draft CoCP, Section 5);
- management of flood risk and other extreme weather events which may affect community resources during construction (draft CoCP, Sections 5 and 16); and
- 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 rehousing (draft CoCP, Sections 7 and 13).

Assessment of impacts and effects

5.4.3 Details of all assessments of community resources are included in Volume 5: Appendix CM-001-024. 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.

Bickenhill

Temporary effects

Residential properties

5.4.4 An area of approximately 570m^2 within the grounds to the north of Common Farm will be required temporarily for approximately six months during the construction period for earthworks associated with the realigned A452 Chester Road, and the diversion of a high-voltage power line. This will result in a minor adverse effect and is therefore not considered to be significant at the community level.

5.4.5 Nine properties, comprising seven properties on Middle Bickenhill Lane and the residential properties at Common Farm and Park Farm on the A452 Chester Road will be located adjacent to an area of land required to construct and operate the proposed Birmingham Interchange station. The properties will be surrounded by construction activities including the Birmingham Interchange station main compound, five satellite compounds and the construction of the Birmingham Interchange station with associated access roads and car parks. During construction, the properties will be surrounded by 2.4m high fencing. To enable the construction and operation of the Birmingham Interchange station and car parks, the northern section of Middle Bickenhill Lane will be closed permanently. The southern section of Middle Bickenhill Lane will remain open, and a turning head will be provided to enable access to land and properties. The A452 Chester Road will provide a construction traffic route, which will result in significant traffic flows and delays to vehicle occupants; this will affect accessibility to Common Farm and Park Farm.

5.4.6 The combination of reduced access and the visual barrier created by the construction works surrounding these properties will result in the isolation of the community for approximately five years and six months. This will be a major adverse effect, and is therefore considered to be significant.

Recreation facilities

5.4.7 The National Motorcycle Museum site is located partially within an area of land required to enable improvement works to the adjacent M42 junction 6 roundabout, as

part of the Proposed Scheme. The roundabout and entry/exit roads will require widening, including the construction of a segregated left turn lane for M42 southbound traffic on the M42 junction 6 roundabout. The proposed works will result in the total loss of approximately 55 car parking spaces for approximately one year and six months during the construction period; however 45 of these spaces will be lost permanently (see permanent effects, Section 5.4). The museum currently provides approximately 274 car park spaces and requires the full capacity of the car park to accommodate a range of large events on a regular basis. There is no convenient alternative parking provision for visitors. The loss of 20% of the museum's car parking spaces for approximately one year and six months will result in a moderate adverse effect, and is therefore considered to be significant.

5.4.8 The Toby Carvery public house and restaurant is located to the north-west of Stonebridge Island. The Toby Carvery public house is currently accessed from the north via the A452 Chester Road, and an exit road is provided to the west onto the A45 Coventry Road. The exit road to the west of the Toby Carvery public house is within an area of land required temporarily for the diversion of a power line associated with the widening and realignment of the adjacent A45 Coventry Road. The proposed works will not affect the use of the road, and are expected to last for less than six months. The Toby Carvery public house could continue to function as intended throughout the construction of the Proposed Scheme. It is therefore concluded that there will be a negligible adverse effect, not considered to be significant.

5.4.9 Melbicks Garden and Leisure centre is situated between the A452 Chester Road and A446 Stonebridge Road. An area of approximately 1,600m2 in the outdoor storage and retail space to the south of the garden centre is required for approximately six months for the removal of a high-voltage power line, required as part of the Proposed Scheme. In addition, approximately 54 car parking spaces (12% of the total parking spaces at the garden centre) will be lost during construction due to the realignment of the A452 Chester Road. It is considered that visitors are likely to require short term parking, resulting in a high turnover of available car park spaces. As such the loss of a small area of parking is not likely to impact on the availability of parking for those visiting Melbicks Garden and Leisure centre. The proposed utility removal and loss of parking spaces will not affect the community facilities within Melbicks Garden and Leisure centre, and will therefore result in a negligible adverse effect, not considered to be significant.

Permanent effects

Residential properties

5.4.10 There is one residential property, Nursery Cottage, located off the A45 Coventry Road, which is within an area of land required permanently for the route and will therefore be demolished. This will result in a minor adverse effect and is therefore not considered to be significant at the community level.

Recreation facilities

5.4.11 Permanent works adjacent to the National Motorcycle Museum include the widening of the A45 Coventry Road and the construction of a segregated left turn lane for M42 southbound traffic on the M42 junction 6 roundabout. The proposed works will result

in the permanent removal of the existing access road to the museum, part of the car park and a grass verge bordering the northern boundary of the museum. The Proposed Scheme will provide a replacement access road to the east of the National Motorcycle Museum from the A45 Service Road. The replacement access road will require the loss of a grassed area of approximately 1,280m^2 to the east of the museum. The replacement access road will ensure that vehicular access is maintained throughout the construction and operation of the Proposed Scheme.

5.4.12 The loss of part of the car park will result in the permanent removal of approximately 45 car parking spaces (16% of the total car parking spaces). The National Motorcycle Museum currently provides approximately 274 car park spaces and requires the full capacity of the car park to accommodate a range of large events on a regular basis. There is no convenient alternative parking provision for visitors. The loss of the grassed areas and existing access will not affect the function of the facility; however the loss of car parking spaces will compromise the ability of the resource to accommodate major events. This will result in a moderate adverse effect, and is therefore considered to be significant.

5.4.13 The access road to the north of the Toby Carvery public house and restaurant is within an area of land required permanently for engineering and landscaping earthworks associated with the proposed widening and realignment of the A452 Chester Road. As part of the Proposed Scheme, the Toby Carvery public house rear access road will be realigned permanently to extend further northwards onto the A452 Chester Road. Access to the Toby Carvery public house will remain throughout the construction period. It is therefore concluded that there will be a negligible adverse effect, not considered to be significant.

5.4.14 The Olympia Motorcycle Track is within an area of a land required for the construction and operation of the route as it leaves Birmingham Interchange station through the Bickenhill cutting. This will result in the permanent loss of the facility, and the demolition of the associated buildings within the site. There are alternative comparable motocross tracks within the West Midlands area, including in Stipers Hill, Bromsgrove, Telford and Coventry. The permanent loss of the facility will result in a moderate adverse effect, and is therefore considered to be significant.

5.4.15 Melbicks Garden and Leisure centre is situated between the A452 Chester Road, and the A446 Stonebridge Road, which will both be realigned as part of the Proposed Scheme. A new A452/A446 roundabout will be provided to the south-west corner of Melbicks Garden and Leisure centre. The existing A452 Chester Road southbound carriageway will be removed just south of Melbicks Garden and Leisure centre, and a new A452 southbound on link road will be constructed. These works will require the permanent closure of the existing access to the garden centre off the A452 Chester Road and the provision of a new access road off the proposed A452 /A446 roundabout. This will result in the permanent loss of approximately 45 car parking spaces (10% of the total parking spaces at the garden centre). It is considered that visitors are likely to require short term parking, resulting in a high turnover of available car park spaces. As such the loss of a small area of parking will not impact on the availability of parking for those visiting Melbicks Garden and Leisure centre. In addition, an area of approximately 650m2 at the rear delivery entrance to the garden

centre will be required for permanent access rights to undertake modifications to a high-voltage power line and occasional maintenance. Access to Melbicks Garden and Leisure centre will be retained throughout the construction period and the removal of a small area of the car park will not affect the function of the garden centre. This will be a negligible adverse effect, and is therefore not considered significant.

5.4.16 The Little Owl public house and restaurant is situated adjacent to the A452 Chester Road/B4438 Bickenhill Parkway roundabout, which will be removed as part of the Proposed Scheme. A new A452/B4438 roundabout will be provided, connecting the B4438 Bickenhill Parkway Link, Northway and B4438 Bickenhill Parkway Link to a new A452 Link Road. Associated highway works will include the realignment of the dedicated access road to the Little Owl public house and restaurant from the new roundabout. The existing vehicular access to the west of the Little Owl public house and restaurant, off the B4438 Bickenhill Parkway, will remain. The realignment will result in the permanent loss of part of the grassed areas at the eastern entrance to the car park, closest to the Holiday Inn Express NEC hotel. The car park and access will remain functional throughout the construction period. The effect will therefore be negligible and not considered significant.

Chelmsley Wood

Temporary effects

Residential properties

5.4.17 A group of residential properties on Yorkminster Drive, Lyecroft Avenue and Bluebell Drive are partially within an area required to undertake works to an overhead power line which passes over these properties. The works will not result in loss of land from any of these properties; therefore residents will not be affected.

Open space and recreational PRoW

5.4.18 The eastern extent of Bluebell Recreation Ground will be situated approximately 100m west of the route as it is constructed on Pool Wood embankment. An area of Bluebell Recreation Ground will be required to undertake works to an overhead power line and two transmission towers currently situated within Bluebell Recreation Ground. Works will be limited to restringing/tensioning of cables, with a limited on-site presence. The proposed works will be undertaken intermittently over a period of approximately six months. The Local Environmental Management Plan will include appropriate measures to minimise impacts on the park. The short term loss of an area of Bluebell Recreation Ground will result in a minor adverse effect and is therefore not considered significant.

5.4.19 Within Heath Park, an area of land approximately 39,150m^2 (49% of the total park) will be required during the construction period. The land will be required for the location of the Coleshill Heath Road underbridge satellite compound at the southern extent of the park and utility works. The satellite compound is required for works associated with lowering Coleshill Heath Road, the construction of the route on Pool Wood embankment and the M6 motorway box structure, for approximately two years and six months. Utility works will include the removal of a transmission tower on the eastern boundary of Heath Park and works to a second overhead power line further north in the park. It is expected that these utility works will take place in advance of

the mobilisation of the satellite compound, for approximately one year. The construction works will result in the temporary loss of parkland and one senior playing pitch. The remaining area of parkland will provide sufficient space to realign one playing pitch during the football season. The loss of parkland, for approximately three years and six months in total, will be a major adverse effect and is therefore considered significant. The Proposed Scheme includes land for the replacement of this open space (see other mitigation measures).

5.4.20 The presence of construction works at Heath Park will result in significant visual and transport effects on users in the southern end of Heath Park. Significant visual effects will be experienced due to views of construction activities associated with the proposed Coleshill Heath Road underbridge satellite compound within the park, and views of tall cranes required for construction of the M6 motorway box structure, and the Coleshill No. 1 embankment (within Coleshill Junction, CFA19). Heavy Goods Vehicles (HGV) will access the satellite compound in Heath Park from a construction entrance on Yorkminster Drive, which may result in disruption to people accessing and using the park. The combination of significant visual and significant HGV effects will result in a moderate adverse effect on the amenity of the users of Heath Park for approximately two years and six months in total, and is therefore considered to be significant.

Permanent effects

Open space and recreational PRoW

5.4.21 The route will pass through the south-east corner of Heath Park on Pool Wood embankment, crossing the location of the southernmost football pitch. This will result in the permanent loss of approximately 8,600m^2 of parkland (11% of the total park). An area of approximately 450m^2 additional accessible parkland will be created through the removal of the existing transmission tower to the north of the grass pitches. The remaining area of parkland will provide sufficient space to realign two playing pitches during the football season. The overall loss of parkland will decrease the amount of public open space available to the local community. This will be a moderate adverse effect, and is therefore considered significant. The Proposed Scheme includes land for the replacement of this open space (see other mitigation measures).

Cumulative effects

5.4.22 No temporary or permanent inter-project cumulative effects have been identified for any of the areas during construction.

Other mitigation measures

5.4.23 The assessment has concluded there are significant adverse effects arising during construction in relation to community resources and residential properties.

5.4.24 The following measures are proposed to mitigate the significant effects arising during construction on Heath Park. It is the intention to continue to work with SMBC to put in place measures to deliver the following:

- temporary loss of land at Heath Park: during the football season, reconfiguration of the existing playing pitch layout at Heath Park and Bluebell

Recreation Ground to provide an additional playing pitch during the construction period and improvement to the pedestrian access to Heath Park and Bluebell Recreation Ground; and

- permanent loss of land at Heath Park: the provision of a new area of public open space off Coleshill Heath Road, with improved pedestrian access from the nearby Chelmsley Wood residential area.

5.4.25 Detailed discussions have been held with SMBC regarding these mitigation options. However as this mitigation is yet to be fully agreed with SMBC, the residual effects have not taken this mitigation into account.

Summary of likely significant residual effects

5.4.26 The National Motorcycle Museum will be temporarily affected due to land required for construction. The amenity of Heath Park in regard to the recreational value it provides will be temporarily affected by the construction of the Proposed Scheme. Residents at Middle Bickenhill Lane, Park Farm and Common Farm will experience temporary isolation effects due to nearby construction works.

5.4.27 The National Motorcycle Museum, Olympia Motorcycle Track and Heath Park will be permanently affected due to land required for the construction and operation of the Proposed Scheme.

5.5 Effects arising from operation

Avoidance and mitigation measures

5.5.1 There are no relevant measures which have been incorporated into the scheme design as part of the design development process.

Assessment of impacts and effects

5.5.2 No significant effects have been identified during operation of the Proposed Scheme.

Cumulative effects

5.5.3 No cumulative effects have been identified during operation of the Proposed Scheme.

Other mitigation measures

5.5.4 The above assessment has concluded there are no predicted significant adverse effects arising during operation, therefore no further mitigation is proposed.

Summary of likely significant residual effects

5.5.5 No significant residual effects on community resources have been identified for the operation of the Proposed Scheme.

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 reports 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 The location of key environmental features are shown on CT-10-053 to CT-10-054a Volume 2, CFA24 map book. Maps showing the location of all designated and non-designated heritage assets can be found on Maps CH-01-153 and CH-02-153, 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 are:

- Appendix CH-001-024 – Baseline Report;
- Appendix CH-002-024 – Gazetteer of Heritage Assets;
- Appendix CH-003-024 – Impact Assessment Table; and
- Appendix CH-004-024 – Survey Reports.

6.1.4 Throughout this section, assets within the study areas are identified with a unique reference code, BIC000; further detail on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-024.

6.1.5 Engagement has been undertaken with Warwickshire County Council (WCC) local authority planning archaeologist and the conservation officer for Solihull Metropolitan Borough Council (SMBC) 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 from the centre line of the route 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 Light Detection and Ranging (LiDAR)[42] 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[43] 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. Within the limitations identified, the information obtained is considered sufficient to undertake a robust cultural heritage assessment for the purpose of this Environmental Impact Assessment.

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-001-024.

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-004-024); and
- a programme of non-intrusive surveys including geophysical surveys (see Volume 5: Appendix CH-004-024).

Designated assets

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

6.3.4 The following designated assets are located within the 2km study area, and are shown on Map CH-02-153, Volume 5, Map Book Cultural heritage:

[42] Light detection and ranging (LiDAR) is a high resolution remote sensing technique to capture 3D data.
[43] 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.

- Little Packington Bridge (BIC058) a scheduled monument of post-medieval date;
- one Grade I listed building, the Church of St. Peter, Bickenhill (BIC057);
- two Grade II* listed buildings, Park Farmhouse (BIC053 and Packington Hall (BIC021);
- twenty-five Grade II listed buildings. The majority of the Grade II listed buildings are located to the east of the Proposed Scheme and are located within or associated with the Packington Estate;
- Packington Hall (BIC003), a Grade II* registered park and garden of 18th century date;
- Bickenhill Conservation Area (BIC051); and
- seven areas of ancient woodland – The Somers (BIC001), Todds Rough (BIC063), site of Chelmsley Wood (BIC091), Birch Wood (BIC066), Bannerly Rough (BIC073), School Rough (BIC088) and Alcott Wood (BIC093).

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:

- important hedgerow (BIC089) located on the boundary between the parishes of Chelmsley Wood and Bickenhill; and
- medieval fields (BIC034) identified through aerial photographic analysis west of Middle Bickenhill Lane.

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:

- road and ford (BIC055), the medieval to post-medieval old road from Hampton to Coleshill;
- a post-medieval rabbit warren and site of a possible farmhouse at Warren Farm (BIC062);
- a post-medieval turnpike road and toll gate (BIC061);
- medieval ridge and furrow (BIC075), south of Blackfirs Lane;
- Common Farm (BIC070), Bickenhill, an 18th and 19th century farmhouse;
- a possible post-medieval earthwork field boundary (BIC 069), east of the M42 and west of Common Farm;
- boundary bank (BIC064), relating to Common Farm, Bickenhill;
- brick kilns (BIC085), west of Brickfield Farm; and

- twenty-five assets identified through LiDAR and aerial photographic analysis comprising mostly medieval field systems, including field boundaries and ridge and furrow as well as clay or gravel pits. The unique identifiers for these assets can be found in Volume 5: Appendix CH-004-024.

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-002-024 and identified on Maps CH-01-154 to CH-01-155a Volume 5, Map Book Cultural heritage.

Cultural heritage overview

6.3.8 The study area is located within the central part of the Arden National Character Area (NCA), which comprises farmland and former wood pasture to the south and east of Birmingham. The underlying solid geology consists of Mercia Mudstone Formation deposits. Within the Mercia Mudstone sequence, around Pendigo Lake in the NEC complex and the M42 junction 6 roundabout, a thicker horizon of interbedded sandstone, siltstone and mudstone, known as the Arden Sandstone member, occurs. This is overlain by a continuous cover of glacial deposits and alluvial superficial deposits that consist mainly of sands and gravels. Further details of the geology of the area contained in land quality (Section 8).

6.3.9 Originally, the landscape within the study area was heavily wooded, with few settlements and minimal active land use. Small scale clearance and seasonal use of woodlands began in the Neolithic period and possible evidence for this can be seen in the area to the east of the M42 (east and north-east of the National Exhibition Centre (NEC) complex), where a possible field boundary, remnants of a field bank and a large rectangular enclosure have been recorded (BIC069). Further prehistoric evidence has been recorded north of Denbigh Spinney in Bickenhill, where a flint blade of Mesolithic date was found.

6.3.10 Whilst river valleys are generally known to have been a focus for Bronze Age settlement, little evidence has been found in the Blythe valley for settlement, agricultural or ritual activity dating to this period. There is also little evidence for later settlement from the Iron Age or Roman period.

6.3.11 In the early medieval (Anglo-Saxon) period, the area was part of the Hwiccan kingdom, which extended over much of what is now Worcestershire, west Warwickshire and Gloucestershire. This later became part of the kingdom of Mercia. A number of early settlements are indicated by place-name evidence, for example at Elmdon, meaning 'elm-tree hill', Great and Little Packington, meaning 'Paca's farm/settlement' and Bickenhill, meaning 'pointed hill or Bica's hill'. Early medieval activity is further evidenced by the line of the old road from Hampton to Coleshill, which crosses Hollywell Brook by the Westaneford.

6.3.12 A number of settlements and manors including Bickenhill, Middle Bickenhill, Wavers Marston and Great Packington are recorded in the Domesday Survey of 1086. Bickenhill seems to have been well established by the 12th century and the parish Church of St. Peter (BIC057) retains fabric of that period. The 12th century Church of St. Bartholomew (BIC050) in Little Packington now lies isolated within the landscape,

but its presence also suggests that Little Packington had early origins. The deserted settlement of Bickenhill (BIC037) is thought to lie within the area south of Park Farm.

6.3.13 Much of the remaining landscape during this period, including areas now part of Coventry, Solihull and Birmingham, were covered by the ancient Forest of Arden. Large scale clearance of the forest began during the medieval period, giving rise to an increase in areas of arable farming and isolated farmstead settlements.

6.3.14 Evidence for medieval agricultural activity in the study area includes areas of ridge and furrow and earthwork field boundaries. Bickenhill Heath is recorded as an area of 162 hectares used for agricultural purposes, but was later divided under the Enclosures Act in the 17th century. The routes of old roadways are preserved between Bickenhill and Meriden and from Church Bickenhill to Stonebridge and Meriden (BIC055).

6.3.15 The manor of Great Packington was part of the large holdings of the Augustinian priory at Kenilworth. Following the dissolution of the monasteries in the 16th century, the manor was purchased by the Priory's tenant John Fisher. It was Fisher's son Clement who demolished the old house (Packington Old Hall) and replaced it with a 'fine new mansion' (BIC021) set within an extensive new deerpark. The deerpark was remodelled by Lancelot 'Capability' Brown during the 18th century, who created a picturesque landscape (BIC003), including the great lakes, with bridges (BIC014) and grottos (BIC013), and a new walled garden. This work coincided with alterations to the hall, with a new classical facade, alongside the addition of lodges at the main approaches. The Church of St. James was constructed in the late 18th century, along with further additions to the park, including the pleasure gardens.

6.3.16 The post-medieval rural economy is more typically represented by small-scale farms and their associated farmhouses. The majority of farm holdings retain their agricultural setting and examples include Park Farmhouse (BIC053), a late 18th century farmhouse and outbuildings, Mill Farmhouse (BIC019), Beam Ends (BIC059), and Common Farm, Bickenhill (BIC070). Farmhouses such as those at 5 Elmdon Road (BIC090) and Alcott Hall (BIC092) have since had their farmland developed and are now part of the urban landscape, while others are evidenced in the historical record.

6.3.17 The Rugby to Birmingham line, part of the former London and Birmingham Railway was built in 1838.The Stonebridge Railway (BIC030), part of the Birmingham and Derby Junction Railway was built in 1839. The railway, which passes on the west side of the Packington Estate within cutting, was closed to passengers in 1917 and was dismantled in the 1950s. The arrival of the railways within the study area represents a significant addition to the landscape. However, on account of there being no consequent expansion of settlement within the study area, there was little impact on historical character.

6.3.18 During the 19th and 20th centuries, the area became a focus for brick-making and other extractive industries. The Historic Environment Record identifies a number of brick kilns in an area located to the west the M42. The Arden Brickworks at Bickenhill (BIC026) retains a 28m deep quarry and further quarry sites are recorded.

6.3.19 Birmingham Airport (previously known as Elmdon) was opened in 1939 as a commercial airport, becoming a focus for much commercial activity and leading to an

expanding road and transport infrastructure including the M6 (1971) and M42 (1976). The NEC complex was opened in 1976 and was expanded in 1989 and 1998. The NEC and airport are served by Birmingham International station which opened in 1976.

Future baseline

Construction (2017)

6.3.20 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. The potential for these developments to alter the current cultural heritage baseline has been reviewed as part of this assessment.

6.3.21 The quarry activities at Park Farm (ref 2011/1959)[44] will remove all archaeological assets within that application area. The assessment of impacts arising from construction of the Proposed Scheme therefore assumes that no cultural heritage (buried archaeological) assets will remain in this area.

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):

- 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 Measures have been incorporated into the design of the Proposed Scheme to reduce the impact on the Grade II* listed Park Farmhouse (BIC053) and the Grade II* registered Packington Hall park and garden (BIC003). These measures include: the vertical alignment of the route as it enters the Birmingham Interchange station, limiting the overall height of the station building; detailed consideration of the access arrangements for the station and the internal road network; and consideration of the

[44] Planning permission ref 2011/1959, National Grid Reference SP206835

design and arrangements for car parking associated with the station to avoid the requirement for multi-storey developments.

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 impacts on the setting of designated or non-designated heritage assets. These impacts will last for approximately five years commencing in 2017 and finishing end of 2022.

- Grade II* listed Park Farmhouse (BIC053), an asset of high value, will be affected by construction activity associated with the construction of Birmingham Interchange station, construction of the haul roads, construction of the Station Exit Link road the presence of construction traffic, construction compounds , storage facilities, workers accommodation, cranes and earthmoving plant. This will impact on the ability to appreciate the relationship between the asset and its agricultural setting. This will constitute a medium adverse impact and a major adverse effect; and
- Common Farm, Bickenhill (BIC070), an 18th and 19th century farmhouse asset of low value, will be affected by construction activities associated with Proposed Scheme including the erection of site hoarding, the construction of the A446 Southbound off link road, the construction of landscape earthworks the presence of lighting, construction compounds and earthmoving plant. These will affect the ability to appreciate the relationship of the asset to its agricultural setting. This will constitute a high adverse impact and a moderate adverse effect.

Cumulative effects

6.4.5 As no committed developments have been identified 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 temporarily or permanently for the construction of the Proposed Scheme:

6.4.7 The road and ford (BIC055, BIC122) leading from Hampton to Coleshill, an asset of low value, will be removed through activities associated with the construction of the Birmingham Interchange station surface level car park (west), the logistics and storage satellite compound and the people mover. This will constitute a high adverse impact and a moderate adverse effect.

6.4.8 A rabbit warren and site of a possible farmhouse at Warren Farm (BIC062), an asset of low value, will be removed as a result of activities associated with construction of the Birmingham Interchange station surface level car park (west) and internal road network. This will constitute a high adverse impact and a moderate adverse effect.

6.4.9 Three former channels (BIC 101, BIC113 and BIC 116), each assets of low value, will be removed by the construction of the Birmingham Interchange surface level car park (west) and construction of the internal road network. This will constitute a high adverse impact and a moderate adverse effect.

6.4.10 Four linear features located to the east of the M42 (BIC040, BIC048,BIC114 and BIC117) each assets of low value, will be removed through the construction of the Birmingham Interchange surface level car park (west) and construction of the internal road network. This will constitute a high adverse impact and a moderate adverse effect.

6.4.11 A road and toll gate (BIC061) and an area of ridge and furrow (BIC107) located to the north of Park Farm, assets of low value will be removed by the construction of the internal road network and the excavation of a detention basin. This will constitute a high adverse impact and a moderate adverse effect.

6.4.12 Ridge and furrow (BIC075), located south of Blackfirs Lane, an asset of low value, will be entirely removed through the realignment of the B4438 Bickenhill Parkway and reconfiguration of the associated roundabout. This will constitute a high adverse impact and a moderate adverse effect.

6.4.13 Two earthwork field boundary banks (BIC064, BIC069) and a linear feature or ditch (BIC118) located east of the M42 each assets of low value, will be entirely removed through activities associated with the construction of the concrete batching and pre cast storage compound and associated construction activities within the area of the Birmingham Interchange station. This will constitute a high adverse impact and a moderate adverse effect.

6.4.14 Brick kilns (BIC085), at a former Brick Yard, west of Brickfield Farm, an asset of low value, will be partially removed through the construction of the route of the Proposed Scheme, the construction of the Pool Wood embankment and temporary materials stockpile. This will constitute a high adverse impact and a moderate adverse effect.

6.4.15 An important hedgerow (BIC089) located on the boundary between the parishes of Chelmsley Wood and Bickenhill, an asset of moderate value, will be partially removed by the route of the Proposed Scheme. This will constitute a medium adverse impact and a moderate adverse effect.

6.4.16 An area of medieval fields located to the west of Middle Bickenhill Lane (BIC034), an asset of moderate value, will be removed by a large number of elements within the Proposed Scheme including the surface level car park (west), the People Mover and the logistics and storage compound. This will constitute a high adverse impact and a major adverse effect.

6.4.17 An area of ridge and furrow located to the west of Middle Bickenhill Lane (BIC 119 and BIC120), an asset of low value, will be removed by the construction of the logistics and

storage satellite compound. This will constitute a high adverse impact and a moderate adverse effect.

6.4.18 Three linear features located to the west of Middle Bickenhill Lane (BIC031, BIC041 and BIC121), each assets of low value, will be removed through the construction of the logistics and storage satellite compound. This will constitute a high adverse impact and a moderate adverse effect.

6.4.19 The site of Mary Hastings Cottage (BIC042), an asset of low value, will be removed through construction associated with the M42 junction 6 roundabout. This will constitute a high adverse impact and a moderate adverse effect.

6.4.20 An area of ridge and furrow located to the south of the B4438 Bickenhill Parkway (BIC115), an asset of low value, will be removed by the construction of the M42 viaduct (west) satellite compound and the placement of two temporary material stockpiles. This will constitute a high adverse impact and a moderate adverse effect.

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

- Grade II* listed Park Farmhouse (BIC053), an asset of high value, will have its setting changed by the Proposed Scheme, including the presence of the Birmingham Interchange station surface level car park (east), the long-stay car park, the Station Exit Link road, internal road access, and the Birmingham Interchange station. These new elements will remove the agricultural setting of the building, reducing its significance as a surviving farmhouse within agricultural surroundings. This will constitute a high adverse impact and a major adverse effect; and
- Common Farm, Bickenhill (BIC070) an 18th and 19th century farmhouse, an asset of low value will have its setting changed by the Proposed Scheme, including changes to the alignment of the A452 Chester Road and associated earthworks, and the A446 northbound on link road. The changes will remove the ability to appreciate the farmhouse within its historic rural setting, affecting the significance of the asset. This will constitute a high adverse impact and a moderate adverse effect.

Permanent cumulative effects

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

Other mitigation measures

6.4.23 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

6.4.24 A range of archaeological assets will be permanently lost due to the construction of the Proposed Scheme, in particular works associated with the Birmingham Interchange station and internal road network. These assets comprise mostly the remains of medieval field systems, in the form of ridge and furrow and linear earthworks. Other archaeological assets include evidence for roads and trackways of probable medieval or post-medieval date. A programme of archaeological works will be prepared to investigate, analyse, report and archive these assets.

6.4.25 There will be an adverse effect on the setting of the Grade II* listed Park Farmhouse and Common Farm arising from the construction of the Proposed Scheme once it is built. Impacts on the setting of the southern parts of the Packington Hall registered historic park and garden will reduce as mitigation planting close to its southern extent matures.

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:

- landscape mitigation planting (scrub/woodland) on the southern edge of Park Farmhouse, and public realm planting associated with Birmingham Interchange station will increasingly reduce impacts on the setting of Park Farmhouse as it matures during the operational phase; and
- woodland habitat creation around the station exit link road and public realm planting associated with Birmingham Interchange station will increasingly reduce impacts on the setting of Packington Hall Park 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, albeit that 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. One effect has been identified on Park Farmhouse (BIC053), a Grade II* listed building and an asset of high value. The impact of an increase in road traffic on the A452 Chester Road, and traffic using the internal road network for Birmingham Interchange station will have a permanent urbanising effect on the asset, eroding its rural quality. This will constitute a medium adverse impact and a major adverse effect.

Cumulative effects

6.5.4 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 significant residual effects

6.5.6 The setting of Park Farmhouse (BIC053) will be adversely affected by operation of the Proposed Scheme on account of traffic movements and other activity within the site of the Birmingham Interchange station.

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 and fragmentation of: broad-leaved semi-natural woodland at Denbigh Spinney Local Wildlife Site (LWS) and Coleshill Pool Wood LWS; and
- loss and fragmentation of the hedgerow network.

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

- ecological baseline data (Volume 5: Appendices EC-004-001 to EC-004-004); and
- register of local/parish level effects which are not described individually in Volume 2 are reported in Volume 5: Appendix EC-005-004.

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: the Environment Agency; Solihull Metropolitan Borough Council (SMBC); Warwickshire Biological Records Centre; Warwickshire Wildlife Trust and the West Midland Bird Club.

7.2 Scope, assumptions and limitations

7.2.1 The scope and methodology of the ecological assessment are introduced in the SMR and SMR Addendum (Volume 5: Appendix CT-001-000/1 and CT-001-000/2 respectively), with further details appended to the SMR. The assessment methodology is summarised in Section 8 of Volume 1, along with route-wide assumptions and limitations. Limitations associated with particular surveys are reported in Volume 5: Appendices EC-004-001 to EC-004-004.

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-002-024.

7.2.3 The surveys that have been undertaken are recorded in Volume 5: Appendices EC-004-001 to EC-004-004.

7.2.4 As well as the standard range of surveys described in the SMR, radio-tracking surveys of several species of bat were undertaken in this area. Trapping and radio-tracking surveys were undertaken at Coleshill and Bannerly Pools SSSI following static recorder and transect surveys undertaken in suitable habitat where scarce species were recorded or considered likely to be present.

7.2.5 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 the quarry workings at Park Farm. Further details are provided in Volume 5: Appendices EC-004-001 to EC-004-004.

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

7.2.7 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 presented in Volume 5: Appendix EC-004-001 to EC-004-004 and Maps EC-01 to EC-12, Volume 5, Map Book Ecology. Statutory and non-statutory designated sites are shown on Maps EC-01-052 to EC-01-054a, Volume 5, Map Book Ecology.

7.3.2 Land required for the construction of the Proposed Scheme and land adjacent to it consists mainly of arable land, improved grassland, hedgerows and small blocks of woodland (including Denbigh Spinney LWS and Coleshill Pool Wood LWS). Land within this area is intersected by: the River Blythe, tributaries of the River Blythe, including Hollywell Brook; and highways, including the A45 Coventry Road, A452 Chester Road, M42, and A446 Stonebridge Road.

Designated sites

7.3.3 There are two statutory designated sites within 500m of the land required for the construction of the Proposed Scheme; both are of national value. They are:

- River Blythe Site of Special Scientific Interest (SSSI) – the River Blythe is designated as the SSSI and a short stretch of the river is located within land required for the construction of the Proposed Scheme at Stonebridge Island, though the Proposed Scheme would not affect the designated habitats. The SSSI is a fine example of a lowland river with a wide range of natural structural features such as riffles, pools, small cliffs and meanders. The structure of the River Blythe is very variable and importance is increased because of the rarity of such examples in lowland England. The River Blythe supports diverse assemblage of aquatic plant and macro-invertebrate communities. It also supports the pea-shell cockle which occurs at the western edge of its range in the River Blythe. This SSSI is crossed by Proposed Scheme in the Balsall Common and Hampton-in-Arden area (CFA23); and
- Coleshill and Bannerly Pools SSSI – designated for two pools (Coleshill and Bannerly Pools) and an area between (the Bogs), which form the only valley mire system in Warwickshire. This SSSI is located south of the M6 junction 4

and east of the M42, and the SSSI and Coleshill Pool Wood LWS (see detail on non-statutory sites, below) were continuous before construction of the M42 motorway. Several plant species which are scarce and have a localised distribution within Warwickshire are associated with the valley mire, including bottle sedge, cross-leaved heath and hare's-tail cotton-grass. Wet woodland also occurs at Coleshill and Bannerly Pools SSSI.

7.3.4 There are two non-statutory designated sites relevant to the assessment in this area. Both are of county/metropolitan value and wholly within land required for the construction of the Proposed Scheme. They are:

- Denbigh Spinney LWS – designated for the wet woodland and the species it supports including marsh violet, which is scarce and has a localised distribution in the West Midlands. The LWS is located adjacent to the junction of the A452 Chester Road and Middle Bickenhill Lane; and
- Coleshill Pool Wood LWS – designated for the broad-leaved semi-natural woodland and the plant species it supports. The LWS is located between the A452 Chester Road and the M42.

Habitats

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

Woodland

7.3.6 The woodland at Denbigh Spinney LWS occurs entirely within land required for the construction of the Proposed Scheme, though a proportion of this site would be retained. The woodland at Denbigh Spinney LWS an alder dominated woodland most similar to the National Vegetation Classification (NVC[45]) plant community W6 *Alnus glutinosa – Urtica dioica* woodland. Birch dominated woodland of the NVC community W4 *Betula pubsecens – Molinia caerulea* woodland occurs at Coleshill and Bannerly Pools SSSI.

7.3.7 These woodlands are wet woodland habitats of principal importance listed under the provisions of Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006[46]) and a conservation priority of Warwickshire, Coventry and Solihull Local Biodiversity Action Plan (LBAP[47]))the LBAP. The wet woodlands at the aforementioned sites support typical species diversity and both are of county/metropolitan value.

7.3.8 As well as wet woodland, there are areas of drier oak woodland of NVC W10 *Quercus robur – Pteridium aquilinum – Rubus fruticosus* woodland within land required for the construction of the Proposed Scheme south of the A45 Coventry Road, the dismantled Hampton-in-Arden to Shustoke line, north-east of Denbigh Spinney LWS, Coleshill Pool Wood LWS and Coleshill and Bannerly Pools SSSI. The W10 woodlands at Coleshill Pool Wood LWS and Coleshill and Bannerly Pools SSSI are partly within

[45] Joint Nature Conservation Committee. The National Vegetation Classification ; http://jncc.defra.gov.uk/page-4259; Accessed June 2013
[46] *Natural Environment and Rural Communities Act 2006* (2006 CHAPTER 16). Her Majesty's Stationery Office, London.
[47] Warwickshire Biodiversity Partnership. *Warwickshire, Coventry and Solihull Local Biodiversity Action Plan* [online]. Available at: http://www.warwickshire.gov.uk/biodiversity; Accessed June 2013

land required for the construction of the Proposed Scheme though there are no works proposed that would result in loss or damage to the SSSI habitats. The W10 woodland south of the A45 Coventry Road, the dismantled Hampton-in-Arden to Shustoke line, north-east of Denbigh Spinney LWS (between the A452 Chester Road and A446 Stonebridge Road) are located within land required for the construction of the Proposed Scheme. Oak and birch woodland of NVC community W16 *Quercurs spp. – Betula spp*. – *Deschampsia flexuosa* woodland occurs at Coleshill and Bannerly Pools SSSI outside land required for the construction of the Proposed Scheme. The W10 and W16 woodlands are lowland mixed deciduous woodland habitats of principal importance and a conservation priority of the LBAP. These broad-leaved semi-natural woodlands at the aforementioned sites, which are prevalent in this part of Warwickshire, support typical species diversity and both are of county/metropolitan value.

Mire

7.3.9 A mire is a wetland habitat that is dominated by living, peat-forming plants that include bog-mosses. Two mire communities are present at Coleshill Pool within Coleshill and Bannerly Pools SSSI: M4 *Carex rostrata – Sphagnum recurvum mire* and M25 *Molinia caerulea – Potentilla erecta mire* around the pool periphery. The M4 and M25 mires are located outside land required for the construction of the Proposed Scheme. M4 and M25 mires are a conservation priority of the LBAP. M4 and M25 mires only occur at this site within Warwickshire and are fine examples of valley mire habitat which support a good diversity of plant and animal species. These mires are both of national value.

Watercourses

7.3.10 The River Blythe is within the land required to construct the Proposed Scheme at Stonebridge Island, though no works would take place within the river channel. Rivers are a habitat of principal importance and are a conservation priority of the LBAP. The River Blythe is a lowland river of high habitat quality and diversity and is of national value.

7.3.11 The route will cross two tributaries of the River Blythe: Hollywell Brook and an unnamed brook at Denbigh Spinney LWS. As part of the Proposed Scheme, sections of both watercourses will be diverted. The rivers and streams are a habitat of principal importance and a conservation priority of the LBAP. A River Corridor Survey and River Habitat Survey of Hollywell Brook were undertaken and are reported in Volume 5: Appendix EC-004-001. The Hollywell Brook shows evidence of previous realignment or over-deepening over significant lengths of the watercourse but still provides a range of aquatic habitats for flora and fauna, including otter, fish and aquatic macro-invertebrates. Hollywell Brook is of district/borough value. The unnamed brook at Denbigh Spinney LWS has a lower diversity of habitat, supports a limited range of species and is of local/parish value.

Hedgerows

7.3.12 There are approximately 15.6 km of hedgerow within the land required for construction of the Proposed Scheme. Hedgerow with at least 80% cover of native woody species is a habitat of principal importance and the majority of recorded

hedgerows meet this criterion. Approximately 12km of the hedgerows were recorded as species-poor and 3.6km as species rich. . Approximately 4.2km of the hedgerows are also classified as 'Important' according to the 'Wildlife and Landscape' criteria described in The Hedgerows Regulations 1997[48] with a further430m considered to be 'possible Important' (because no access was available for survey). Most native species-rich and 'Important' hedgerows occur at Park Farm and to a lesser extent at Brickfield Farm. Many of the native species-rich hedgerows include mature pedunculate oaks which is characteristic of the area. The hedgerows within the area also function as wildlife corridors. The hedgerow network as a whole is of district/borough value.

Water bodies

7.3.13 Several water bodies containing eutrophic[49] standing water occur within land required for the construction of the Proposed Scheme. These are a habitat of principal importance and a conservation priority of the LBAP. There are two pools between the A446 Stonebridge Road and the M42 at Coleshill and Bannerly Pools SSSI, which are located outside of the land required for the construction of the Proposed Scheme. These pools are a primary reason for the designation of the SSSI and are therefore assessed as being of national value.

7.3.14 Pendigo Lake at the National Exhibition Centre (NEC) is a large water body and of local/parish value. A cluster of 12 ponds north of Middle Bickenhill Lane and three pools at Brickfield Farm are also of local/parish value.

Grassland

7.3.15 Marshy grassland occurs on both sides of Hollywell Brook at Park Farm and along the east side of the River Blythe within land required for the construction of the Proposed Scheme. The marshy grassland at Park Farm and alongside the River Blythe is most similar to NVC community MG10 *Holcus lanatus – Juncus effusus* rush pasture and is a habitat of principal importance and a conservation priority of the LBAP. The marshy grassland is characterised by the presence of Yorkshire fog, soft-rush and creeping buttercup. There is a transition from marshy grassland to marginal vegetation towards Hollywell Brook. In areas where the marshy grassland is occasionally inundated the NVC community S7 *Carex acutiformis* swamp is prevalent. NVC community MG4 *Alopecurus pratensis – Sanguisorba officinalis* grassland is a (lowland meadow) habitat that is present adjacent to Hollywell Brook at Park Farm. MG4 grassland is of principal importance and a conservation priority of the LBAP. The MG10, MG4 and S7 plant communities together support a relatively low diversity of characteristic species that are of district/borough value.

7.3.16 Semi-improved neutral grasslands that are characteristic of NVC communities MG5 *Cynosurus cristatus – Centaurea nigra* grassland and MG6 *Lolium perenne – Cynosurus cristatus* grassland occur adjacent to marshy grassland at Park Farm within land required for the construction of the Proposed Scheme. MG5 and MG6 grasslands are lowland meadow habitats of principal importance and a conservation priority of the

[48] *The Hedgerow Regulations 1997 (1997 No. 1160).* Her Majesty's Stationery Office, London.
[49] Eutrophic waters are those that contain mineral and organic nutrients which support a proliferation of plant life, especially algae.

LBAP. The MG5 and MG6 semi-improved neutral grasslands at Park Farm support a low diversity of characteristic species and together are of district/borough value.

Marginal vegetation

7.3.17 Marginal vegetation occurs on both sides of Hollywell Brook in areas of frequent inundation at Park Farm within land required for the construction of the Proposed Scheme. The marginal vegetation is a swamp habitat characteristic of S14 *Sparganium erectum* swamp, with water mint, woody nightshade, meadowsweet, common marsh-bedstraw, hemlock water-dropwort, wild angelica, brooklime, great willowherb and common nettle. Stands of S12 *Typha latifolia* swamp occurs around Coleshill Pool within Coleshill and Bannerly Pools SSSI. The S12 and S14 marginal vegetation at Coleshill and Bannerly Pools SSSI and Park Farm supports a low diversity of common and widespread species. The marginal vegetation at these sites is of local/parish value.

Protected and/or notable species

7.3.18 A summary of the species relevant to the assessment is provided in Table 8.

Table 8: Protected and/or notable species

Species/ Species group	Value	Receptor	Baseline and rationale for valuation
Plants	County/ metropolitan	Floating club-rush in a cluster of 12 ponds north of Middle Bickenhill Lane	This species has a localised distribution in England and is typically found in certain seasonally flooded sites. It is a rare species in the Warwickshire area. It is present within land required for the construction of the Proposed Scheme.
Birds	Up to District/borough	A wintering barn owl at Park Farm	A single barn owl (which is a Schedule 1, Amber List and LBAP species) was recorded during the winter survey period within land required for the construction of the Proposed Scheme. Barn owl is a scarce species in Warwickshire.
	Up to District/borough	A population of woodcock at Park Farm	A single woodcock (which is an Amber List species) was recorded during one winter survey visit, within land required for the construction of the Proposed Scheme. There is suitable woodland habitat that could sustain a small population.
	Local/parish	A wintering bird assemblage at Park Farm.	A total of 46 species were recorded during the survey period within land required for construction of the Proposed Scheme. Eight Red List species and 14 Amber List species (including oystercatcher and golden plover) were recorded.
	Local/parish	A breeding bird assemblage at Brickfield Farm.	Breeding territories of 16 common species were recorded during the survey period within land required for construction of the Proposed Scheme, including two Red List species.
	Local/parish	A breeding bird assemblage at Park Farm.	Breeding territories of 18 species were recorded at Park Farm within the land required to construct the Proposed Scheme, mostly at low density, including three Red List and four Amber List species.

Species/ Species group	Value	Receptor	Baseline and rationale for valuation
Terrestrial invertebrates	County/ metropolitan	A weevil *Notaris scirpi* at Park Farm.	This species was recorded in marginal vegetation alongside Hollywell Brook within land required for construction of the Proposed Scheme. It has a localised distribution in England and is rare in Warwickshire.
Aquatic macro-invertebrates	County/ metropolitan	A diving beetle *Rhantus suturalis* in a cluster of 12 ponds north of Middle Bickenhill Lane	This species was recorded in ponds within land required for the construction of the Proposed Scheme and has a localised distribution in England and is rare in Warwickshire.
	County/ metropolitan	A diving beetle *Hydroporus neglectus* at Coleshill and Bannerly Pools SSSI	This species was recorded outside land required for the construction of the Proposed Scheme. It has a localised distribution in England and is rare in Warwickshire.
	County/ metropolitan	Aquatic macro-invertebrate assemblage at Coleshill and Bannerly Pools SSSI (excluding the diving beetle Hydroporus *neglectus*) .	A high diversity of aquatic macro-invertebrate species of importance within Warwickshire was recorded in the pools within the SSSI and outside land required for construction of the Proposed Scheme.
	District/borough	Aquatic macro-invertebrate assemblage across a cluster of 12 ponds north of Middle Bickenhill Lane (excluding *Rhantus surtalis*) and three ponds at Brickfield Farm.	A moderate diversity of aquatic macro-invertebrate species was recorded at these ponds which are within land required to construct the Proposed Scheme.
Bats	County/ metropolitan	A population of barbastelle at Coleshill and Bannerly Pools SSSI.	Barbastelle is a rare species[50] in England and is of principal importance. Two passes' of this species were recorded in May 2013 by a static bat detector during surveys outside the land required for construction of the Proposed Scheme at Coleshill and Bannerly Pools SSSI. It was not recorded by other survey methods (including transect surveys and trapping and radio tracking within the SSSI) at this or other locations for CFA 24. This record is likely to represent a north-westerly extension to the distribution range of this species. Habitats suitable for barabstelle in the vicinity of the Proposed Scheme include woodland and wetland at Coleshill and Bannerly Pools SSSI and woodland of Coleshill Pool Wood

[50] Bat Conservation Trust (2012). State of the UK's Bats 2012

Species/ Species group	Value	Receptor	Baseline and rationale for valuation
			LWS. Urban habitats to the west of the Proposed Scheme are less suitable. Suitable and extensive woodland, wetland and parkland foraging habitat for barbastelle is present east of the route at Packington Estate and in the surrounding wider landscape to the east and outside the land required to construct the Proposed Scheme.
	Up to District/borough	Population of Leisler's bat at Park Farm.	This species is localised in England and scarce in Warwickshire (probably because it is under-recorded). A single pass of this species was recorded from a static bat detector over a 5 night duration in April 2013 (but not recorded again in repeat surveys in May and July 2013) alongside Hollywell Brook at Park Farm within land required to construct the Proposed Scheme. It is probable that a small population of this species occurs in the area.
	Up to District/borough	Populations of serotine at Coleshill and Bannerly Pools SSSI and Park Farm	This species is localised in England and scarce in Warwickshire (probably because it is under-recorded). Single passes of this species were recorded by static bat detectors alongside Hollywell Brook at Park Farm within land required to construct the Proposed Scheme, and at Coleshill and Bannerly Pools SSSI outside land required to construct the proposed scheme. It is probable that a small population of this species occurs in the area.
	Local/Parish	Assemblage of whiskered bat, common pipistrelle, soprano pipstrelle and brown long-eared bat at Coleshill and Bannerly Pools SSSI, Coleshill Pool Wood LWS and Brickfield Farm	Small populations of these species were recorded within and outside land required to construct the Proposed Scheme. Soprano pipistrelle and brown long-eared bat are species of principal importance. Two common pipistrelles (and four noctules) were recorded emerging from a pedunculate oak at Coleshill and Bannerly Pools SSSI, outside the land required to construct the Proposed Scheme. No roosts were recorded at Coleshill Pool Wood LWS or Brickfield Farm. A single whiskered bat was trapped and identified at Coleshill and Bannerly Pools SSSI.
	Local/parish	Assemblage of common pipistrelle, soprano pipstrelle and brown long-eared bat in the area around Park Farm including buildings and farmland at Park Farm, two residential properties on	Small populations of these common species were recorded within and outside land required to construct the Proposed Scheme. Soprano pipistrelle and brown long-eared bat are species of principal importance. Five common pipistrelles were recorded emerging from a building at Park Farm outside land required to construct the Proposed Scheme. Two common pipistrelles were recorded emerging from two residential properties along Middle Bickenhill Lane, outside the land required to

Species/ Species group	Value	Receptor	Baseline and rationale for valuation
		Middle Bickenhill Lane, land east of A452 Chester Road.	construct the Proposed Scheme. A common pipistrelle and a brown long-eared bat were recorded emerging from a barn north of the A45 Coventry Road and east of the River Blythe, which is outside land required to construct the proposed Scheme. A soprano pipistrelle was recorded emerging from a pedunculate oak south of the A45 Coventry Road and east of the River Blythe SSSI, within land required for the construction of the Proposed Scheme. These species were recorded foraging and commuting along Hollywell Brook at Park Farm, within land required to construct the Proposed Scheme..
	Local/parish	Population of noctule bat at Park Farm and Coleshill and Bannerly Pools SSSI.	Small numbers of this species were recorded foraging and commuting along Hollywell Brook at Park Farm within land required to construct the Proposed Scheme and also at Coleshill and Bannerly Pools SSSI outside land required to construct the Proposed Scheme. Four noctule bats (and two common pipistrelles) were recorded emerging from a pedunculate oak at Coleshill and Bannerly Pools SSSI outside land required to construct the Proposed Scheme. Noctule is a species of principal importance.
	Local/parish	Population of Natterer's bat at Park Farm.	Natterer's bat was recorded foraging and commuting along the Hollywell Brook within land required to construct the Proposed Scheme.
Otter	District/borough	Otter population at River Blythe, Hollywell Brook and adjacent habitats within land required for the construction of the Proposed Scheme.	A small population of this species of principal importance and a conservation priority of the LBAP. Otter footprints, spraints and feeding remains (containing American signal crayfish) were recorded alongside Hollywell Brook at Park Farm and a potential holt on the Hollywell Brook, within land required to construct the Proposed Scheme.
Amphibians	County/ metropolitan	A meta-population of great crested newt in four ponds north of Packington Lane and east of the A446 Stonebridge	A medium population of this species of principal importance and a conservation priority of the LBAP. Information from the desk indicated that a moderate population of this species with a peak count of 86 adults (across all four ponds) which are outside land required for construction of the Proposed Scheme was recorded by Argus Ecology[51] on 12 May 2012.

[51] Argus Ecology (2102). Packington CHP Facility, Little Packington Landfill Site, Warwickshire: Great Crested Newt Survey Report.

Species/ Species group	Value	Receptor	Baseline and rationale for valuation
		Road.	
	District/borough	A population of great crested newt in the northern pool at Coleshill and Bannerly Pools SSSI.	A low population of this species of principal importance and a conservation priority of the LBAP. A peak count of two adults was recorded during the survey period in ponds outside land required for construction of the Proposed Scheme.
	District/borough	A population of common toad in pond at Brickfield Farm.	A good population of this species of principal importance and a conservation priority of the LBAP. A peak count of approximately 600 adults was recorded during the survey period within land required for construction of the Proposed Scheme.
Reptiles	Local/parish	A population of grass snake on the eastern verge of the A452 Chester Road near Park Farm.	A low population of this species of principal importance and a conservation priority of the LBAP. One adult was recorded during the survey period on the road verge of the A452 within land required for construction of the Proposed Scheme. Grass snake may be present in other areas where surveys were incomplete, including Hollywell Brook but would still not be valued at more than local/parish level.
	Local/parish	A population of slow-worm on the eastern verge of the A446 Stonebridge Road.	A low population of this species of principal importance and a conservation priority of the LBAP. Four adults recorded during the survey period within land required for construction of the Proposed Scheme.
Badger	Local/parish	At least three social groups at undisclosed locations (which include a main sett, an annexe and three outlier setts)	A common and widespread species recorded during the survey period. There are badger setts located within land required for the construction of the Proposed Scheme.
Fish	Local/parish	Assemblage of freshwater fish within Hollywell Brook, including minnow.	The watercourse supports reasonable diversity and population densities for a small brook which is within land required for construction of the Proposed Scheme.

Future baseline

Construction (2017)

7.3.19 A summary of the known developments which are assumed to be mostly built and occupied prior to construction of the Proposed Scheme is provided is provided in Volume 5: Appendix CT-004-000.

7.3.20 The extraction of sand and gravel within the new quarry at Park Farm, A452 Chester Road, Middle Bickenhill commenced in Spring 2013. A small area of MG4 grassland is

located alongside the Hollywell Brook to the east of the dismantled Hampton-in-Arden to Shustoke line. Consented quarry activities will result in the loss of MG4 grassland and other habitats. If the quarry is not restored to agricultural land before the construction start date, then there is potential that for sand/gravel to be present which is a suitable nesting habitat for sand martin and little ringed plover (which is a Schedule 1 species) to be present. If present, depending on the population sizes little ringed plover could be up to district/borough value. Sand martin would also be a component of the existing breeding bird assemblage which would remain as local/parish value.

Operation (2026)

7.3.21 There are no known additional committed developments or changes to management in this area that will affect the operational baseline, beyond those described above in relation to the construction 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:

- the works at Stonebridge Island have been designed to avoid construction within the River Blythe SSSI;
- the highways works associated with the A446 has been designed to avoid adverse effects associated with the Proposed Scheme within Coleshill and Bannerly Pools SSSI;
- the realignment of Hollywell Brook has been designed to include a naturalised channel and reduce potential adverse impacts on riparian plants and river-based animals;
- the use of a clear span bridge over Hollywell Brook has been included as part of the design of the Proposed Scheme to reduce the shading impact on riparian plants and river-based animals that they support; and
- the Proposed Scheme has been designed to reduce habitat loss within Denbigh Spinney LWS.

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

Assessment of impacts and effects

Designated sites

7.4.3 The A45 Coventry Road/A452 Chester Road (Stonebridge Island) satellite compound and temporary material stockpiles are located in the floodplain of the River Blythe north-east and south-east of Stonebridge Island with land required for improvements to Stonebridge Island. The River Blythe channel (which is the SSSI) will not be adversely affected by the Proposed Scheme, including highway works associated with

Stonebridge Island. Measures within the draft CoCP would avoid indirect impacts on the SSSI including control of water quality from site drainage during construction.

7.4.4 The Proposed Scheme necessitates the realignment of an unnamed watercourse on the east side of Birmingham Interchange station over a distance of approximately 70m across Denbigh Spinney LWS. This will result in the loss of approximately 0.2ha (30%) of W6 wet woodland at Denbigh Spinney LWS. The watercourse realignment is likely to affect drainage in the remaining part of the wet woodland and will affect the remaining plant communities including areas of the LWS that support marsh violet. Habitat loss and changes to drainage will result in a permanent adverse effect on site integrity and be significant at county/metropolitan level.

7.4.5 The route and proposed Pool Wood embankment will cross Coleshill Pool Wood LWS. Approximately 3.4ha (70%) of broad-leaved semi-natural woodland will be cleared for a road head, temporary material stockpile and earthworks associated with construction of the Pool Wood embankment. The removal of broad-leaved, semi-natural woodland will fragment the LWS leaving one area approximately 1.4ha in size. Fragmentation and isolation of habitat of this magnitude will result in a permanent adverse effect on site integrity which will be significant at county/metropolitan level.

7.4.6 No impacts are anticipated on the integrity of the River Blythe SSSI. There would be no loss or damage of habitat as there are no works within the designated SSSI boundary. The CoCP will control site construction operations including drainage, to avoid adverse effects.

7.4.7 No impacts are anticipated on the integrity of the Coleshill and Bannerly Pools SSSI. Due to the diversion of overhead power lines (the diversion is not within the SSSI), tensioning works may need to be undertaken at an existing transmission tower in Coleshill and Bannerly Pools SSSI. The tensioning works within land required for the construction of the Proposed Scheme are not intrusive and there will be no impact on the integrity of the SSSI.

Habitats

7.4.8 The realignment of an unnamed watercourse across Denbigh Spinney LWS will result in the loss of approximately 0.2ha (30%) of W6 wet woodland. The W6 wet woodland at Denbigh Spinney LWS is a habitat of principal importance and is listed in the LBAP. Habitat loss of this extent and consequent draining part of the boggy areas adjacent to the watercourse will result in a permanent adverse effect on the conservation status of this area of wet woodland which will be significant at county/metropolitan level.

7.4.9 Construction activities associated with Pool Wood embankment at Coleshill Pool Wood LWS, including a roadhead and temporary material stockpile will result in the loss of approximately 5ha (96%) of W10 woodland. This W10 woodland at Coleshill Pool Wood LWS is a habitat of principal importance and is listed in the LBAP. Habitat loss of this extent will result in a permanent adverse effect on the conservation status of broad-leaved semi-natural woodland which will be significant at county/metropolitan level.

7.4.10 Watercourse realignment works required for the construction of the Bickenhill embankment will result in the permanent loss of an approximate length of 300m length of Hollywell Brook. Hollywell Brook supports a typical diversity of riparian species and is a habitat of principal importance and listed in the LBAP. Habitat loss of this extent will result in a permanent adverse effect on the conservation status of the Hollywell Brook which will be significant at district/borough level.

7.4.11 As a precaution, it is assumed that all hedgerows (approximately 15.6km) within the land required to construct the Proposed Scheme will be lost. This will also fragment the remaining hedgerow network). These impacts will result in a permanent adverse effect on the conservation status of the hedgerow network which will be significant at district/borough level.

7.4.12 Ground works for car parks and access roads north of the proposed Birmingham Interchange station will result in the loss of 12 ponds to the north of Middle Bickenhill Lane and construction of Pool Wood embankment will result in the loss of three ponds at Brickfield Farm. These ponds support typical species diversity and are habitats of principal importance and listed in the LBAP. The loss of these ponds will result collectively in a permanent adverse effect on their conservation status which will be significant at district/borough level.

7.4.13 Ground works in the floodplain of Hollywell Brook associated with construction of the Bickenhill embankment, people mover and adjacent service road and realignment of Hollywell Brook will result in the loss of 4.7ha (100%) of MG10 rush pasture. The MG10 grassland near Hollywell Brook supports a low diversity of species that are associated with this habitat of principal importance which is listed in the LBAP. Habitat loss of this extent will result in a permanent adverse effect on conservation status which will be significant at district/borough level.

7.4.14 Ground works associated with the construction of Bickenhill embankment, Birmingham Interchange station, people mover and adjacent services road will result in the loss of 1.95ha (100%) of grassland of NVC type MG5 and MG6. The MG5 and MG6 grassland at Park Farm support a low diversity of species that are associated with this habitat of principal importance which is also listed in the LBAP. Habitat loss of this extent will result in a permanent adverse effect on conservation status which will be significant at district/borough level.

7.4.15 No impacts are anticipated on the following habitats, which form part of the baseline, because they are sufficiently distant from land required for the construction of the Proposed Scheme: W4 and W16 woodland; and M4 and M25 mire communities.

7.4.16 It is unlikely that any other effects on habitat receptors at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-004.

Species

7.4.17 Ground works associated with Bickenhill cutting and the adjacent access roads to the A452/A446 roundabout will result in the loss of 12 ponds to the north of Middle Bickenhill Lane. These ponds north of Middle Bickenhill Lane support floating club-rush and a diving beetle *Rhantus suturalis* which is scarce and has a localised

distribution in the Warwickshire. The loss of all these ponds will result in a permanent adverse effect on the conservation status of *Rhantus suturalis* which will be significant at county/metropolitan level. The loss will also result in a permanent adverse effect on floating club-rush which will be significant at country/metropolitan level.

7.4.18 It is assumed that ground works in the floodplain of the Hollywell Brook associated with construction of the Bickenhill embankment, people mover and adjacent service road and realignment of Hollywell Brook will result in the loss of marginal vegetation that supports a weevil *Notaris scirpi,* which is scarce and has a localised distribution in the West Midlands. Loss of suitable marginal habitat adjacent to Hollywell Brook as a result of realignment and loss of marshy grassland is likely to result in reduction of the *Notaris scirpi* population size, though sufficient vegetation is likely to be retained along the Brook to maintain the presence of this species during construction. This will result in a permanent adverse effect on the conservation status of *Notaris scirpi* which will be significant at district/borough level.

7.4.19 The earthworks required for the construction of the Pool Wood embankment at Brickfield Farm will result in the loss of three ponds, including a large pond which supports a moderate population of common toad. Habitat loss of this extent will result in a permanent adverse effect on conservation status of this population which will be significant at district/borough level.

7.4.20 The construction of Birmingham Interchange station, internal road network, car parks and balancing ponds will result in the permanent loss of grassland and field margin foraging habitat for barn owls. Barn owl is a Schedule 1 and Amber List species which is included in the LBAP. As a precaution, it is assumed that the loss of habitat affects different barn owl to that present in the breeding site recorded in CFA 23 to the south, resulting in a permanent adverse effect on barn owl conservation status at the local/parish level.

7.4.21 Loss of habitat will also remove foraging and commuting habitat and affect Serotine and Leislers' bat, resulting in an adverse effect on each species at the local/parish level.

7.4.22 Barbastelle bat was not recorded within the land required for construction of the Proposed Scheme and most suitable habitat for this species occurs on land to the east of the Proposed Scheme with land to the west comprising the urban areas of the Birmingham Business Park and Chelmsley Wood. There would be no adverse effect on conservation status of this species.

7.4.23 Loss of habitat for otter as well as loss of a potential holt site as a result of construction of the Hollywell Brook underbridge and realignment of the Hollywell Brook will result in an adverse effect on conservation status of this species at the local/parish level.

7.4.24 Although there are great crested newt breeding ponds at Coleshill and Bannerly Pools SSSI and north of Packington Lane within 250m of the land required for construction of the Proposed Scheme, the confirmed breeding ponds are outside the land required and there would be no loss of terrestrial habitat that would affect conservation status. Implementation of appropriate mitigation measures described within the draft CoCP

and Environmental Minimum Requirements (Volume 5: Appendix CT-001-000/2) will avoid adverse impacts on the conservation status of this species during construction.

7.4.25 No impacts are anticipated on golden plover, woodcock or skylark as they are likely to displace to suitable nearby habitats.

7.4.26 It is unlikely that any other effects on species receptors at more than the local/parish level will occur. This includes the effect of hedgerow and other habitat losses on the conservation status of breeding birds at Park Farm and other bat populations recorded at Park Farm, Coleshill Wood LWS and Brickfield Farm.

7.4.27 Effects at the local/parish level are listed in Volume 5: Appendix EC-005-004.

Other mitigation measures

7.4.28 This section describes additional measures designed to reduce or compensate for significant ecological effects. These include habitat creation, habitat enhancement and routes for wildlife to move across the Proposed Scheme.

7.4.29 Approximately 33ha of native broad-leaved woodland will be created by planting native tree and shrub species. This comprises substantial areas of woodland planted primarily for ecological purposes (habitat creation) as well as other landscape planting of native broadleaf woodland. The target habitat type is lowland mixed deciduous woodland habitat of principal importance. The woodland habitat creation areas will be created in suitable locations to provide a link between fragments as well as additional replacement woodland adjacent to the A452 Chester Road in the vicinity of Denbigh Spinney LWS. These works will be carried out in accordance with the ecological principles of mitigation as provided in Volume 5: Appendix CT-001-000/2. Following the establishment and maturation of new woodland planting there will be a beneficial effect on the conservation status of broad-leaved woodland at the local/parish level.

7.4.30 The existing Hollywell Brook culvert under the dismantled Hampton-in-Arden to Shustoke line which is about 30m long will be removed. The realigned sections of the Hollywell Brook which have a combined length of approximately 330m will be naturalised with a profile to promote the establishment of marginal vegetation and pools. This will result in a beneficial effect on the conservation status of the Hollywell Brook at the local/parish level.

7.4.31 The provision of marginal vegetation alongside the Hollywell Brook will also provide habitat for the weevil *Notaris scirpi* which is rare in Warwickshire. This will maintain the conservation status of the local population of this species.

7.4.32 Approximately 1.6km of native species-rich hedgerow will be established in accordance with the ecological principles of mitigation, including translocation as appropriate. A diverse range of native tree and shrub species will be used. There will remain a residual adverse impact on conservation status as the network will not be re-established, though the combination of new hedgerows combined and linked with the new woodland planting will reduce the adverse effect to the local/ parish level.

7.4.33 Approximately 12.2ha of marshy grassland will be created either side of Hollywell Brook adjacent to retained marshy grassland. Areas identified for marshy grassland creation will be specifically designed to provide suitable ground conditions for

establishment. Natural regeneration will be favoured for the development of the most appropriate plant communities, although supplementary plug planting using native species will be used to ensure the key and definitive marshy grassland species establish. These works will be carried out in accordance with the ecological principles of mitigation (Volume 5: Appendix CT-001-000/2). This will result in a beneficial effect at local/parish level.

7.4.34 Approximately 18.2ha of species rich neutral grassland will be created north of Siding Wood to the east of the A452 Chester Road widening, Birmingham Interchange station access road verges and on the sides of the Pool Wood embankment. Areas identified for neutral grassland creation will be specifically designed to provide suitable ground conditions for establishment. Natural regeneration will be favoured for the development of the most appropriate plant communities and in accordance with the ecological principles of mitigation. This will result in a beneficial effect at local/parish level.

7.4.35 Habitat creation measures, including the re-creation of marshy and neutral grassland will compensate for the loss of foraging habitat for barn owl. Following the implementation of the measures proposed it is anticipated that adverse impacts on barn owl will be reduced to a level at which they will not result in any residual significant adverse effect on barn owl conservation status.

7.4.36 Compensatory habitat to address the loss of ponds where diving beetle *Rhantus suturalis* was recorded in ponds north of Middle Bickenhill Lane will be provided in advance on land adjacent to the southern boundary of Coleshill and Bannerly Pools SSSI, in accordance with the ecological principles of mitigation, including translocation where appropriate. This will include the provision of two replacement ponds, terrestrial habitat and hibernation habitat sufficient to maintain the favourable conservation status of the population affected.

7.4.37 These new ponds will also be suitable to support floating club-rush and through implementation of the ecological principles of mitigation, including translocation where necessary; there would be no residual effect on the conservation status of this species.

7.4.38 The habitat creation measures detailed above, including the establishment of native broad-leaved woodland, hedgerows, grassland and ponds, will compensate for bat foraging habitats lost to the Proposed Scheme. The appropriate establishment of native broad-leaved woodland, hedgerows and watercourse will also help maintain bat dispersal corridors and enable future movement across the route. No residual significant effect on the conservation status of bat species is predicted.

7.4.39 Compensatory habitat to address impacts on the common toad population at Brickfield Farm will be provided in advance on land adjacent to the southern boundary of Coleshill and Bannerly Pools SSSI, in accordance with the ecological principles of mitigation. This will include the provision of two replacement ponds, terrestrial habitat and hibernation habitat sufficient to maintain the favourable conservation status of the population affected.

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

Summary of likely significant residual effects

7.4.41 Taking into account mitigation, compensation and enhancement measures there are no significant residual adverse effects.

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:

- In accordance with the ecological principles of mitigation, culverts will be suitably designed, where appropriate, with ledges to allow passage for mammals such as badger, otter and water vole, taking into account flood events, or will have an alternative dry tunnel installed; Hollywell Brook underbridge will have a clear span and will be up to 4 m above ground level to allow bats to pass along watercourse below the bridge; and
- Landscape and ecological mitigation habitats for the Proposed Scheme comprise open grassland habitats and no woodland planting alongside the route within approximately 200m of Coleshill Pool Wood LWS to avoid increasing the risk of bat collisions with trains.

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 route. 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. Through implementation of the mitigation measures previously detailed it is anticipated that the operational impact of the Proposed Scheme to the bat populations which are known to forage and disperse across the route, will be reduced at Hollywell Brook underbridge.

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 There are two locations on the route where there is considered to be a risk of bats crossing the Proposed Scheme and where local populations could be impacted through collisions with passing trains or associated turbulence. These are above the proposed Hollywell Brook underbridge and also at Pool Wood embankment.

7.5.7 Though a low level of barbastelle bat activity has been recorded and only at Coleshill and Bannerly Pools SSSI outside land required to construct the Proposed Scheme, a precautionary approach is taken for this species at this particular location. Barbastelle may currently cross the M42 toward the land required to construct the Proposed Scheme as, prior to construction of the M42, Coleshill Pool Wood LWS would have been contiguous with the SSSI woodland. The urban nature of areas located immediately to the west of Coleshill Pool Wood LWS and Brickfield Farm means it is likely that the land west of the M42 and east of Birmingham Business Park and urban area of Chelmsley Wood represents a relatively small area on the western periphery of a much larger barbastelle range to the east of the Proposed Scheme. The majority of woodland within Coleshill Pool Wood LWS will be necessary for the construction of Pool Wood embankment, and so the risk of barbastelle being present and thus at risk of mortality from turbulence or train collision is reduced. The effect on the conservation status of barbastelle could be up to local/parish level.

7.5.8 Small populations of Leisler's bat and serotine at the Hollywell Brook underbridge and serotine at Pool Wood embankment are likely to largely avoid the risk of collision as their higher flight patterns mean they are less likely to collide with trains. Though collisions cannot be completely discounted, the effect of mortality is predicted to have an effect on the conservation status of the local populations of both species at up to local/parish level.

7.5.9 Other bat species including common and soprano pipistrelle, brown long-eared bats and natterer's bats, foraging and commuting along the Hollywell Brook would preferentially pass underneath the line using the Hollywell Brook Underbridge which is up to 4m above ground level. Impacts of mortality from turbulence or collision with trains here or at Pool Wood embankment may occur but are predicted to have no significant effect on the conservation status of the local populations.

7.5.10 The noise made by passing trains has the potential to disturb birds within habitats close to the route. 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.

7.5.11 The majority of bird species that are known to be present in the area are not considered to be particularly vulnerable to collision with trains. However, barn owls hunt low over the rough grassland habitats that are associated with railway embankments and are slow moving which make them more are risk to train strike. Evidence suggests that such mortality is likely to result in the loss of all breeding populations of barn owls within 1.5km of the Proposed Scheme.

7.5.12 A barn owl winter foraging territory extends across Park Farm. It is likely that barn owls will be vulnerable to train strike and associated turbulence. A precautionary approach assumes this is different barn owl to that present within the Balsall Common and Hampton-in-Arden area (CFA 23) to the south, which would be impacted during construction and operation, this will result in a separate permanent adverse effect on the conservation status of barn owl which will be significant at district/borough level.

7.5.13 It is unlikely that any other effects at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume5: Appendix EC-005-004.

Other mitigation measures

7.5.14 This section describes additional elements designed to reduce or compensate for significant ecological effects. These include measures (such as habitat manipulation and fencing) to discourage species from foraging close to the Proposed Scheme:

- In accordance with the ecological principles of mitigation, (Volume 5: Appendix CT-001-000/2) fencing will be provided at Bickenhill embankment to safely guide otter and badger under Hollywell Brook underbridge; and
- To offset the likely loss of barn owl from the vicinity of the Proposed Scheme, opportunities to provide barn owl nesting boxes in areas greater than 1.5km from the route would be explored with local landowners to enhance barn owl populations in existing habitats that would not be affected by the Proposed Scheme. Following the implementation of the measures proposed, it would be anticipated that adverse impacts on barn owl as a consequence of the operation of the Proposed Scheme would be reduced to a level at which they would not result in any significant effect on the conservation status of this species.

Summary of likely significant residual effects

7.5.15 Taking into account mitigation, compensation and enhancement proposed, the residual operational effect is an adverse effect on the conservation status of barn owl due to mortality from collision with trains. However, following the provision of the nesting boxes proposed it would be anticipated that adverse impacts on barn owl would be reduced to a level where they are 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 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 contaminated 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 River Blythe and Hollywell Brook; large areas of superficial sand and gravel deposits that have been widely exploited; Birmingham Airport and the National Exhibition Centre (NEC) complex providing a large urban area within an area that is mostly undeveloped; and Coleshill and Bannerly Pools SSSI.

8.1.4 The main land quality issues in this area include:

- the presence of five historical and one operational landfill;
- the presence of two significant infilled borrow pits between the M42 and Middle Bickenhill Lane; and
- a mineral safeguarding area (MSA) for sand and gravel extraction located within the triangle of land between the M42, A45 Coventry Road and A452 Chester Road. The proposed Interchange Station is located within this triangle of land.

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 Scope and Methodology Report (SMR) and Appendix CT-001-000/2 the SMR Addendum; and
- Volume 5: Appendix LQ-001-024: Land quality data 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 16.

8.1.7 Engagement has been undertaken with Solihull Metropolitan Borough Council (SMBC) and North Warwickshire Borough Council (NWBC) environmental health departments, and the Environment Agency regarding contaminated land. Engagement has also been undertaken with the Policy and Spatial Planning Department of SMBC and Sustainable Communities Department of Warwickshire County Council (WCC) regarding mineral resources. Engagement has also been undertaken with SITA UK Ltd who operate Packington Landfill, located on the Packington Estate.

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 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. The assessment excludes new or diverted utilities that will be located within the boundaries of existing highways. These are scoped out of the assessment as although there is work below ground, it is predominantly within highway construction i.e. non-contaminative materials. These are low risk with regard to land contamination issues, and therefore unlikely to cause any significant land quality effects.

8.2.3 Familiarisation visits to the study area were made in July 2012 where the location of the Proposed Scheme was viewed from points of public access only. Due to access constraints, not all sites considered to have the greatest potential for contamination were visited. However the purpose of the site visits is to verify desktop information, and the lack of complete site walkovers is considered unlikely to have substantially impacted the land quality assessment. Site visit notes are presented in Volume 5: Appendix LQ-001-024.

8.3 Environmental baseline

Existing baseline

8.3.1 Unless otherwise stated, all features described in this section are presented in Maps LQ-01-053, LQ-01-053-L1 and LQ-01-054a, Volume 5, Map Book Land quality). The grid references given for linear features typically refer to the extent of the feature within the study area, which is the area of land required to construct the Proposed Scheme and 250m buffer.

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 on Map WR-02-024, Volume 5, Map Book Water resources.

8.3.3 The Proposed Scheme in this study area mostly crosses agricultural land; however, made ground is present at a number of locations, notably associated with backfilled ponds and pits, together with licensed landfills. There are five historical and one operational landfill within the study area. Further details of these are given in Table 9.

8.3.4 In addition to recorded landfill sites, known areas of made ground are present along the Proposed Scheme in the following locations (the grid references are provided for Map LQ-01-053, Volume 5 Map Book Land quality):

- an area used to place unsuitable material from the construction of the M42 adjacent to the A45 Coventry Road/M42 junction 6 roundabout (shown on Map LQ-01-053, G9, Volume 5, Map Book Land quality);
- made ground, present along the dismantled Hampton-in-Arden to Shustoke line (shown on Map LQ-01-053, F4, G5, G6, G7, H7 and H8, Volume 5, Map Book Land quality);
- a backfilled borrow pit, between the M42 and Middle Bickenhill Lane (shown on Map LQ-01-053, F8 to G9, Volume 5, Map Book Land quality). This was associated with the construction of the M42 and is thought to have been backfilled with material unsuitable for the motorway development. Six trial pits were excavated in this area in 2001 which recorded made ground up to 3m deep (Volume 5: Appendix LQ-001-024 provides a review of a report for a ground investigation undertaken in this area). The made ground comprised reworked natural deposits. Four soil samples taken at that time from the made ground did not record significant contamination (see Volume 5: Appendix LQ-001-024);
- spoil from excavation of a balancing pond west of Middle Bickenhill Lane (shown on Map LQ-01-053, F7, Volume 5, Map Book Land quality);
- made ground possibly associated with the construction of the adjacent A452 Chester Road, (shown on Map LQ-01-053, F5, Volume 5, Map Book Land quality);
- a large infilled borrow pit, between the M42 and Middle Bickenhill Lane (shown on Map LQ-01-053, D7 to F8, Volume 5, Map Book Land quality). This was associated with the construction of the M42 and thought to have been backfilled with material unsuitable for motorway development. Six trial pits were excavated in this area in 2001 which recorded made ground between 0.7m and 5.8m deep containing bricks, concrete, ceramics, glass, tarmacadam, timber, wire, plastic and cloth (Volume 5: Appendix LQ-001-024 provides a review of a report for a ground investigation undertaken in this area). Seven soil samples taken from the infilled borrow pit in 2001 did not record significant contamination. Gas monitoring in 1995 recorded elevated methane and carbon dioxide (Volume 5: Appendix LQ-001-024); and
- to the west of the M42 associated with the construction of the NEC complex, Birmingham International station and Birmingham Airport.

8.3.5 There are also several infilled pits, excavations and ponds as well as possible marl pits located within the study area. These areas are listed in Volume 5: Appendix LQ-001-024.

8.3.6 Superficial glacial deposits are present across much of the study area. A continuous cover of glacial deposits is present from approximately 150m north of Hollywell Brook to the end of the study area at the M6 junction 4. Most of the glacial deposits beneath the route are Glaciofluvial sands and gravels, which are extensive but not continuous, and constitute a significant local aggregate resource. Between Birmingham Business Park and the M6 junction 4, Glaciolacustrine deposits of clay and silt, overlie the Glaciofluvial sand and gravels. Fluvial/alluvial deposits are present across the lower parts of the valley of the River Blythe and Hollywell Brook. Superficial deposits are locally absent or discontinuous in the study area at the location of the NEC complex and Birmingham Airport.

8.3.7 The Mercia Mudstone Group underlies much of the study area. Mercia Mudstone typically comprises weak red brown silty mudstone with minor amounts of carbonate and gypsum when unweathered. Occasional beds of dolomitic siltstone occur within the Mercia Mudstone which are generally thin and when unweathered are a medium strong rock. Within the Mercia Mudstone sequence, around Pendigo Lake in the NEC complex and the A45 Coventry Road/M42 junction 6 roundabout, a thicker horizon of interbedded sandstone, siltstone and mudstone, known as the Arden Sandstone member, occurs.

Groundwater

8.3.8 There are two categories of aquifer identified within the study area. The Arden Sandstone, the Glaciofluvial Deposits and Fluvial/Alluvial Deposits are classified as Secondary A aquifers and Mercia Mudstone is classified as a Secondary B aquifer. The Glaciolacustrine Deposits in the north of the study area are classed as an unproductive stratum.

8.3.9 Within the study area there is one licensed groundwater abstraction (consisting of two boreholes) at the Melbicks Garden and Leisure centre, (shown on Map LQ-01-053, C5 and C6, Volume 5, Map Book Land quality). The Environment Agency information records both deep and shallow wells, but the depths have not been provided. The water is used for horticulture and nursery use within the garden centre. No other groundwater abstractions or private groundwater users are recorded within the study area, and there are no groundwater source protection zones.

8.3.10 One licensed soakaway is present at the site of the former Brackenlands Farm Landfill (shown on Map LQ-01-053, B5, B6, C5 and C6, Volume 5, Map Book Land quality), for final sewage effluent.

8.3.11 Further detail on the groundwater beneath the Proposed Scheme can be found in Water resources and flood risk assessment (Section 13).

Surface waters

8.3.12 Hollywell Brook flows from the west of Birmingham International station in the west to the River Blythe in the east, into which it runs. The River Blythe is designated as an ecological SSSI of high value. Pendigo Lake is located within the NEC complex.

Hollywell Brook enters the west of Pendigo Lake in culvert and flows out of the east of the lake. Several other minor streams are located in the study area.

8.3.13 Coleshill and Bannerly Pools SSSI, which contains ponds and marshland, is present to the east of the M42 and to the west and east of the A446 Stonebridge Road (shown on: Map WR-03-041, D4 to E5, Volume 5, Map Book Water resources).

8.3.14 Several springs are located along Hollywell Brook as well as in the area of the Coleshill and Bannerly Pools SSSI and are described further in Volume 5: Appendix WR-002-024.

8.3.15 No surface water abstractions are recorded within the study area. There are final effluent sewage and site drainage discharge consents to a tributary of the River Blythe relating to the site of Jacksons Brickworks Trading Estate (part of the wider Jacksons Brickworks Landfill adjacent to the A45 Coventry Road (see Volume 5: Map LQ-01-053, H6, H7 and H8). There are also site drainage discharge consents relating to the operational Packington Landfill (shown on Map LQ-01-053, B1 to E5, Volume 5, Map Book Land quality). These consents state that these discharge into a tributary of the River Blythe.

8.3.16 Further information on surface waters is provided in Water resources and flood risk assessment (Section 13).

Current and historical land use

8.3.17 Commercial and industrial development, which may be potentially contaminative, within the survey area includes:

- Jacksons Brickworks Trading Estate, including Bickenhill Waste Recycling Centre located adjacent to the south of the A45 Coventry Road (shown on Map LQ-01-053, H6 to H8, Volume 5, Map Book Land quality);
- the NEC complex to the west of the M42. Businesses in the complex include the NEC, LG Arena, hotels, commercial units and associated infrastructure, including car parks (shown on: Map LQ-01-053, C8 to F10 and continuing onto Maps LQ-01-053-L1, C1 to F3, Volume 5, Map Book Land quality);
- Elmdon Trading Estate (Map LQ-01-053-L1, B2, B3 to D4, Volume 5, Map Book Land quality) and Bickenhill Trading Estate (Map LQ-01-053-L1, C2 and C3, Volume 5, Map Book Land quality) located to the north of the NEC complex;
- Birmingham International station and the Rugby to Birmingham line (shown on Map LQ-01-053-L1, C4 to G3, Volume 5, Map Book Land quality);
- Birmingham Airport including the main fuel depot which is located approximately 375m south-west of the main terminal building (shown on Map LQ-01-053-L1, B4 to E8, Volume 5, Map Book Land quality);
- Olympia Motorcycle Track on the site of the former Middle Bickenhill Lane Landfill (shown on Map LQ-01-053, E5 to E7, Volume 5, Map Book Land quality);

- Melbicks Garden and Leisure Centre between the A452 Chester Road and the A446 Stonebridge Road (shown on Map LQ-01-053, C5 to C6, Volume 5, Map Book Land quality);
- Packington operational landfill adjacent to the east of the A446 Stonebridge Road (shown on Map LQ-01-053, B1 to E5, Volume 5, Map Book Land quality);
- Birmingham Business Park to the south-east of Chelmsley Wood (shown on Map LQ-01-054a, G7 to I9 and H10, Volume 5, Map Book Land quality); and
- a Highways Agency depot located to the north-west of the M6 junction 4 (shown on Map LQ-01-054a , E5 and F5, Volume 5, Map Book Land quality).

8.3.18 In addition, potentially contaminative historical land uses include pits and ponds that have been infilled (see Volume 5: Appendix LQ-001-024), the dismantled Hampton-in-Arden to Shustoke line (shown on Map LQ-01-053, diagonally from D1 to J10, Volume 5, Map Book Land quality), a former smithy north of the Stonebridge Island (shown on Map LQ-01-053,H4, Volume 5, Map Book Land quality) and a disused brickworks located to the south of the M6 junction 4 near Brickfield Farm (shown on Map LQ-01-054, G6 and G7, Volume 5, Map Book Land quality).

8.3.19 There are five historical and one operational landfills in the study area and these are detailed in Table 9. A wide range of contaminants may be associated with the different types of wastes accepted. In addition, these sites may be emitting landfill gases, such as methane and carbon dioxide. There is a lower risk of contaminants and generation of landfill gas at the landfills which have accepted inert waste only.

Table 9: Landfill sites located within the study area

Name	Location	Description
Jacksons Brickworks Landfill (historical)	Located between the start of the study area and the A45 Coventry Road. Shown on: Map LQ-01-053, H6 to J10, Volume 5, Map Book Land quality.	The site was licensed to accept inert, industrial, commercial, household and special waste from the 1990s, although Waste Regulatory Authority inspection records suggest that infilling had not commenced by 1995[52]. In 2000, the waste licence was amended to allow infilling using inert waste only and the licence was surrendered in 2005. A smaller area of landfilling in the north-western area of the site where the current waste transfer station is located (named in Environment Agency records as rear of Jacksons Brickworks) is recorded between 1966 and 1972. The type of waste used for infilling in this area is unknown. Aerial and historical mapping indicates that landfilling may not have been undertaken in the southern and eastern parts of the site, whereas historical pits shown in the north and west of the site appear to have been infilled. Desk study information indicates that the site has extant minerals permission for clay extraction, with the eastern part of the site still being un-worked (see Volume 5: Appendix LQ-001-024 for more details).

[52] The waste disposal licence, Waste Regulatory Authority inspection notes and certificate of completion for Jacksons Brickworks Landfill are provided in Volume 5: Appendix LQ-001-024. Environment Agency landfill records are also provided.

Name	Location	Description
Middle Bickenhill Lane Landfill (historical)	Currently occupied by the Olympia Motorcycle Track. Located adjacent to the north of Middle Bickenhill Lane and west of the A452 Chester Road. Shown on: Map LQ-01-053, E5 to E7, Volume 5, Map Book Land quality.	Recorded as accepting inert, industrial, commercial, household and special waste between 1962 and 1985. The licence to dispose of waste for the site issued in 1978 states that only virgin subsoil, inert hardcore and inert builders rubble can be accepted at the site (post 1978)[53]. Site inspection records (dated 24 February 1977) one year prior to the issue of the waste disposal licence, record a history of fly tipping of domestic and industrial waste at the site including straw cladding, shop fittings, waste paper, cardboard, furniture and tyres. It is stated that it is unknown whether this material was removed from site or placed in the landfill once the waste disposal licence was issued. Environment Agency records state that the base and sides of the natural depression which were formerly present on the site comprised Keuper Marl (now known as Mercia Mudstone). The waste disposal licence holder went into receivership in December 1982 and the licence became void. SMBC purchased the site and developed it into Olympia Motorcycle Track. It is unknown what remediation, if any, was undertaken at this time. Environment Agency records state that a report dated 1988 indicates that a perimeter survey did not detect significant landfill gas. One trial pit was undertaken in the landfill in 2001 and recorded made ground to more than 4.1m and frequent fragments of wire, steel tubing, cloth, plastic, rubber, timber, glass and pottery (Volume 5: Appendix LQ-001-024 provides a review of a report for a ground investigation undertaken in this area). Two soil samples taken from the trial pit did not record significant contamination; however, the majority of the landfill has not been investigated.
Brackenlands Farm Landfill (historical)	Adjacent to the south-east of the A452/A446 roundabout. Bordered by the A452 Chester Road to the west and north and the A446 Stonebridge Road to the east. Shown on: Map LQ-01-053, B5 to C6, Volume 5, Map Book Land quality	Recorded to have accepted inert and liquid/sludge waste (including wastewater, sewage sludge and chemical waste mixed with municipal solid waste) between 1975 and 1977[54]. The waste was placed in a former sand and gravel pit approximately 2m to 6m deep. SMBC records for the site state that approximately 70,000m^3 of sewage sludge from the former Saltley sewage works was placed in the western half of the site. SMBC records state that the sludge fill contains high levels of metallic contaminants and is covered with 0.3m of soil.
Windbridge Nurseries Landfill (historical)	To the south of Birmingham International station and to the north of the A45 Coventry Road. Shown on: Map LQ-01-053-L1, F3 and F4, Volume 5, Map Book Land quality	Recorded to have accepted inert waste between 1979 and 1982[55]. The waste licence was issued in March 1980 and surrendered in April 1994; however the company went into liquidation in 1982. Disposal of waste at the site occurred prior to the issue of the waste disposal licence. The site was licensed for disposal of natural soil, concrete and brick rubble spoil. Records indicate that some unpermitted wastes, tree stumps and scrap metal were deposited at the site in 1981, however as the site licence holder went into liquidation in 1982 these materials were not removed.

[53] The waste disposal licence and the SMBC and Environment Agency database records including site inspection records for Middle Bickenhill Lane Landfill are provided in Volume 5: Appendix LQ-001-024.
[54] The SMBC and Environment Agency database records, a Department of the Environment and Transport report (1986), a Severn Trent Water letter dated 12 September 1984, a report of Director of Environmental Health and trading Standards dated 28 November 1991 and a report detailing testing undertaken on soils and grasses at Brackenlands Farm dated 7 August 1991 are provided in Volume 5, Appendix LQ-001-024
[55] Environment Agency database records for the Windbridge Nurseries Landfill are provided in Volume 5: Appendix LQ-001-024.

Name	Location	Description
Packington Landfill (operational)	A large landfill bordered by the A446 Stonebridge Road to the west and Packington Lane to the east. Shown on: Map LQ-01-053, B1 to E5 Volume 5, Map Book Land quality	The site is operated by Sita UK Ltd and accepts non-hazardous, commercial and industrial waste. Landfilling originally commenced in the north of the current site area and a variety of waste types were accepted, including sewage sludge, pulverised fuel ash and liquid wastes (including organic, oil, metallic, acid, alkali and cyanide wastes). Since 1994, the landfill has used lining and capping systems and gas and leachate collection systems. A perimeter cut-off wall was retrospectively installed in areas previously landfilled with no lining system between 1979 and 1995. The site also contains ancillary waste operations, including an anaerobic digestion plant, composter, wood shredder, leachate treatment plant and landfill gas plant. The landfill is due to cease accepting waste in 2014 and will be restored to a park end use.
Coleshill Civic Amenity Site Landfill (historical)	Adjacent to the A446 Stonebridge Road in the west and Coleshill and Bannerly Pools SSSI to the north. Shown on: Map LQ-01-054a, H2 and G3 to H4 Volume 5, Map Book Land quality	The site is recorded to have accepted inert, industrial, commercial and household waste between 1964 and 1980. The site was originally operated by Blue Circle Aggregates, however a site licence was issued in 1977 to Warwickshire County Council for untreated domestic and commercial waste, non-hazardous industrial waste, hardcore and inert cover material[56]. The site is an old sand quarry with the base of the quarry in the Keuper Marl (now known as Mercia Mudstone).

8.3.20 Typical contaminants that could be generated from potentially contaminated land uses, both historical and current, including oils, fuels, solvents, ground gases (methane, carbon dioxide and volatile organic compounds), asbestos and metals. All potentially contaminated sites (identified from both current and historical land uses) are shown on Maps LQ-01-053 to LQ-01-054a, Volume 5, Map Book Land quality.

Other regulatory data

8.3.21 Regulatory data reviewed includes pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences). A number of these have been recorded in the study area and notable data is as follows:

- permits for mobile screening and crushing equipment and the blending, packing, leading and use of bulk cement, and waste management licenses for the civic amenity waste transfer site (Bickenhill Waste Recycling Centre), are in place at Jacksons Brickworks Trading Estate (shown on Map LQ-01-053, H6 to H8, Volume 5, Map Book Land quality);
- two minor pollution incidents to controlled waters have occurred at Pendigo Lake (shown on Map LQ-01-053-L1, E2 to F1, Volume 5, Map Book Land quality), relating to diesel spillages. Potable supply is noted to have been

[56] Environment Agency database records for the Coleshill Civic Amenity Site Landfill are provided in Volume 5: Appendix LQ-001-024.

affected during one of the incidents, however the Environment Agency hold no record of potable abstraction at Pendigo Lake;

- three further minor pollution incidents to controlled waters have occurred where Hollywell Brook flows in a culvert beneath the Rugby to Birmingham line (shown on Map LQ-01-053-L1, F3, Volume 5, Map Book Land quality). Each of these incidents relates to oil in the culvert; and
- one minor pollution incident has occurred at Birmingham International rail station (shown on Map LQ-01-053-L1, D3 to E3, Volume 5, Map Book Land quality), where 1,200 gallons of diesel was spilt as a result of vandalism.

Mining and mineral areas

8.3.22 Policy P13 of the Solihull Unitary Development Plan (SUDP) (2006)[57] defines MSAs for important mineral resources. Within these MSAs, proposals for non-mineral development will only be permitted where it can be demonstrated that the development will not result in the sterilisation of mineral resources, the loss of important infrastructure or sites of potential infrastructure need in the area.

8.3.23 Policies ENV3 and ENV6 of the North Warwickshire Local Plan (NWLP) (2006)[58] relate to land resources and their protection during development, and the identification, protection and enhancement of designated sites respectively. Emerging policy contained in the North Warwickshire Local Plan Core Strategy (NWLPCS) (2013)[59] include the requirement to avoid the sterilisation of mineral reserves (Policy NW8); and the conservation and enhancement of the natural and historic environment including geo-diversity (Policies NW11 and NW12).

8.3.24 The Minerals Local Plan for Warwickshire (1995)[60] aims to safeguard parcels of land where there are mineral resources of economic or conservation value (Policy M1) and safeguards against the sterilisation of potentially workable minerals by ensuring their removal prior to development (Policy M5). The Minerals Local Plan for Warwickshire (1995) also includes provision for large infrastructure projects not to adversely affect the Minerals Local Plan.

8.3.25 The Glaciofluvial deposits (sands and gravels) that overlie the Mercia Mudstone form a locally important aggregate resource. The Proposed Scheme will traverse adjacent to several areas of former aggregate extraction, some of which have since been filled with waste. These include excavations of the glacial sands and gravels at Denbigh Spinney and on the site of the Packington Landfill.

8.3.26 At the location of the proposed Birmingham Interchange station there is a MSA for sand and gravel extraction located within the triangle of land between the A45 Coventry Road in the south, the M42 in the west and the A452 Chester Road in the east (shown on Map LQ-01-053, Volume 5, Map Book Land quality). In June 2012, the SMBC Planning Committee granted approval for the commercial extraction of sand

[57] Solihull Metropolitan Borough Council (2006), *Solihull Unitary Development Plan*, 2006
[58] North Warwickshire Borough Council (2006), *North Warwickshire Local Plan*, 2006
[59] North Warwickshire Borough Council (2013), *North Warwickshire Local Plan, Core Strategy* (Submitted Version).
[60] Warwickshire County Council (1995), *Minerals Local Plan for Warwickshire*.

and gravel from Park Farm Quarry (also known as Stonebridge Quarry), Bickenhill[61]. The site falls within the south-eastern part of the triangular shaped sand and gravel MSA between the A45 Coventry Road, the M42 and the A452 Chester Road. Quarrying operations at this site commenced in spring 2013 and are focused in the land immediately west, south and east of Park Farm with a working depth of approximately 9m. A shallower area of quarrying to approximately 4m is proposed immediately north of the A45 Coventry Road. The quarry will be backfilled with inert waste.

8.3.27 The Minerals Local Plan for Warwickshire designates the land to the east of the boundary between Solihull and Warwickshire, as a MSA for sand and gravel extraction. This area extends east from the Stonebridge Island northwards through Packington Landfill. To the north of Packington Landfill, the MSA extends eastwards from the M42 and north of the M6 (shown on Volume 5: Map LQ-01-054a, Volume 5, Map Book Land quality).

8.3.28 A building stone MSA relating to an outcrop of Arden Sandstone is located to the north-east of Chelmsley Wood between the M6 and M6 (Toll) either side of Green Lane.

8.3.29 The Mercia Mudstone has historically been dug locally for marl. The resulting small pits occur sporadically, where the Mercia Mudstone is close to the surface. The Mercia Mudstone was also dug for brick making at Jacksons Brickworks south of the A45 Coventry Road, and has extant permission for clay extraction[62]. Mercia Mudstone is not identified as a mineral resource within the SUDP (2006) and the Minerals Local Plan for Warwickshire (1995).

Geo-conservation resources

8.3.30 There are no geo-conservation sites within the study area.

Receptors

8.3.31 The sensitive receptors that have been identified within this study area are summarised in Table 10.

Table 10: Summary of receptors

Issue	Receptor Type	Receptor description	Receptor sensitivity
Land contamination	People	Residents (Mill Farm, Middle Bickenhill Lane, Park Farm, Common Farm, Brackenlands Farm, Brickfield Farm, Chelmsley Wood)	High
		Workers (Jacksons Brickworks Trading Estate, NEC complex, Birmingham Airport, Melbicks Garden and Leisure centre, Birmingham Business Park)	Moderate
		Rail passengers in station areas and station users (Birmingham Interchange station and people mover stations). Post-construction only.	High

[61] Planning Permission ref 2011/1959, National Grid Reference SP206835
[62] ROMP (Review of old mineral permissions) unified set of conditions in 1997 (ref 97/416)

Issue	Receptor Type	Receptor description	Receptor sensitivity
	Controlled waters	Secondary A aquifers (Arden Sandstone bedrock, Glaciofluvial Deposits and Alluvium)	High
		Secondary B aquifer (Mercia Mudstone)	Moderate
		Rivers (River Blythe SSSI, Hollywell Brook and three unnamed tertiary rivers)	High
		Other surface watercourses and water bodies (Pendigo Lake)	Moderate
	Built environment	Buildings and property – various: see people above	Low to High
		Underground structures and services	Low to High
	Ecological	River Blythe SSSI	High
		Coleshill and Bannerly Pools SSSI	High
	Mineral resources	MSAs for sand and gravel – between the M42, A45 Coventry Road and A452 Chester Road and to the east of the A446 Stonebridge Road and the north of the M6.	Low
Impacts on mining/mineral sites	Mining/ mineral sites	MSAs for sand and gravel – between the M42, A45 Coventry Road and A452 Chester Road and to the east of the A446 Stonebridge Road and the north of the M6.	Moderate

Future baseline

Construction (2017)

8.3.32 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. The potential for the baseline to change in the lead up to construction is limited to the extent that any new developments alter the potential for contamination to be present, for example as a result of remediation as part of the development, or changes the mineral status of a site, for example by removing or sterilising a mineral resource. Any new development in the study area on potentially contaminated land will need to be suitable for its intended use as set out in the National Planning Policy Framework (NPPF)[63]. To meet this requirement new development sites may require remediation to be undertaken. This will mean that some areas described as potentially contaminated as a result of the current and historical land use, may no longer be of significance at the time of construction of the Proposed Scheme. No known committed developments are located on sites described as potentially contaminated as a result of current and historical land use at the present time.

8.3.33 Extraction of sand and gravel at the Park Farm Quarry (also known as Stonebridge Quarry) commenced in spring 2013. By 2017 at the start of the construction of the Proposed Scheme it is anticipated that the quarrying operations at Park Farm Quarry

[63] Department for Communities and Local Government (2012). *National Planning Policy Framework*.

will be mostly complete with quarrying estimated to be finished by 2019 (six years after commencing). Infilling of part of the quarry with inert waste is likely to have commenced in the Phase 1 and 2 quarrying locations around Park Farm in the north of the site. Infilling and restoration is programmed to be completed by 2025 (six years after excavation ceases). Consequently the future baseline at construction will include infilling operations as well as quarrying operations at the site and this has been taken into account in the contaminated land and mineral resources assessments.

Operation (2026)

8.3.34 By 2026 the quarrying, infilling and restoration operations at the Park Farm Quarry site will be complete and the site restored to agriculture. Consequently the future baseline at operation at this site will have changed from a quarrying and infilling land use to agriculture. This change in future baseline does not affect the assessment of land quality operational effects.

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

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 CoCP (see Volume 5: Appendix CT-003-000). 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:

- methods to control noise, waste, dust, odour, gasses 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);
- traffic management to ensure that there is a network of designated haul roads to minimise compaction/degradation of soils (draft CoCP, Section 7); and
- methods to monitor and manage flood risk and other extreme weather events which may affect land quality during construction (draft CoCP, Section 16).

8.4.2 The draft CoCP requires that prior to and during construction 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)[64i] and
- British Standard BS10175 Investigation of Potentially Contaminated Sites (2011)[65].

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)[66]. 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. Techniques are likely to include stabilisation methods, soil washing and bio-remediation to remove oil contaminants. Contaminated soil disposed of off-site will be taken to a soil treatment facility, another construction site (for treatment, as necessary, and reuse) or to an appropriately permitted landfill.

Assessment of impacts and effects

8.4.5 Construction of the Proposed Scheme through this section of the route will mostly require cutting below existing ground levels. However, the route will cross above the M42 and M6 on embankment and viaduct. A small section between the A45 Coventry Road and the Birmingham Interchange station will also sit on an embankment and the people mover will be on an elevated viaduct. The major feature of the Proposed Scheme within this area is the Birmingham Interchange station, which will include surface level car parking and connecting road infrastructure. A depot will also be constructed for the people mover, to the south of Birmingham Interchange station as shown on Map LQ-01-053, G7, Volume 5, Map Book Land quality.

8.4.6 Construction works will include earthworks, utility diversions, deep foundations, temporary dewatering and other activities. In addition, significant road infrastructure works will be required within this section of the Proposed Scheme.

[64] Environment Agency (2004), *CLR11 Model Procedures for the Management of Land Contamination*.
[65] *British Standard BS10175 (2011), Investigation of Potentially Contaminated Sites*.
[66] Sustainable Remediation Forum UK (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Remediation*.

8.4.7 The route crosses the Jacksons Brickworks Landfill and Middle Bickenhill Lane Landfill in cutting (Diddington cutting and Bickenhill cutting, respectively). Car parks, new roads and drainage channels are also proposed within the footprint of the Middle Bickenhill Lane Landfill. Consequently earthworks will be likely to include some excavation of landfill materials.

8.4.8 The Brackenlands Farm Landfill and Packington Landfill are located adjacent to road infrastructure works with undergrounding of the Western Power high-voltage power line adjacent to the access road at Brackenlands Farm Landfill and a new cut off ditch adjacent to the edge of Packington Landfill. Works to the overhead power lines are also proposed in the south-west of Packington landfill, although no below ground intrusive works are proposed. The requirement for remediation will depend on the degree of contamination encountered and the extent of earthworks required which is anticipated to be limited to the area of the utilities diversion at Brackenlands Farm Landfill and negligible at Packington Landfill. A new balancing pond and access road are proposed adjacent to the south of Coleshill Civic Amenity Site Landfill with a drainage ditch running along the southern boundary of the site. Signalling works may be required along the Rugby to Birmingham line adjacent to Windbridge Nurseries Landfill. Intrusive works are expected to be negligible within Coleshill Civic Amenity Site Landfill and Windbridge Nurseries Landfill.

8.4.9 The Birmingham Interchange station main site compound will be located to the north-west of the Birmingham Interchange station. The compound will include maintenance facilities for plant and machinery and fuel storage in bunded tanks. During construction, a concrete batching and precast concrete production facility will be located west of the Birmingham Interchange station main compound.

8.4.10 A logistics and storage area will be located immediately to the north of the Birmingham Interchange station temporary workers accommodation satellite compound. This area will include a material processing area for recycling demolition materials and aggregates for reuse (to include crushing, screening and grading plants) (See Map CT-05-106-L1, G2, Volume 2, CFA24 Map Book) This area will also be used to store and treat unsuitable material. Adjacent areas will be used for the temporary storage of soil stripped as part of the works. Workers accommodation will be located to the north of the A45 Coventry Road, between the M42 and Middle Bickenhill Lane.

Land contamination

8.4.11 In line with the assessment methodology, as set out in the SMR, SMR Addendum and its appendices, 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, 63 areas were considered during this screening process; 25 of these areas were taken forward to more detailed risk assessments (Stages C and D), in which the potential risks were assessed more fully. Fourteen of the areas undergoing the more detailed risk assessments were historical landfills or infilled pits/ponds. The remaining 11 sites taken to the Stage C and D assessment were located within the footprints of the dismantled Hampton-in-Arden to Shustoke line, the Rugby to Birmingham line, Birmingham International station, three farms, a garage, Melbicks Garden and Leisure centre, a depot,

Birmingham Business Park and a former smithy. All areas assessed are shown on Maps LQ-01-053 to LQ-01-054a, Volume 5, Map Book Land quality, and those considered as potentially posing a risk to the Proposed Scheme are labelled with a reference number.

8.4.12 Conceptual site models (CSM) have been produced for the 25 areas taken to Stage C and D assessments. The detailed CSMs are provided in Volume 5: Appendix LQ-001-024 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 on or off the Proposed Scheme or associated offline works; e.g. roads;
- 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.

8.4.13 Sites requiring detailed risk assessment have been grouped, and assessed together, where appropriate. Further detail on the basis for the CSM groups is presented in Volume 5: Appendix LQ-001-024. The groups are defined as follows:

- CSM Group A: Sites within the land required to construct the Proposed Scheme, potentially containing soil/groundwater contamination and ground gas;
- CSM Group B: Sites within the land required to construct the Proposed Scheme, potentially containing soil/groundwater contamination only;
- CSM Group C: Sites that fall outside of the land required to construct the Proposed Scheme, potentially containing soil/groundwater contamination and ground gas; and
- CSM Group D: Sites that fall outside of the land required to construct the Proposed Scheme, potentially affected by soil/groundwater contamination only. There are no group D sites within the study area.

8.4.14 A summary of the baseline CSM is provided in Table 11. 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 11: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area reference [67]	**Area name and classification**	**Main potential impacts**	**Main baseline risk**[68]
24-1, 24-2, 24-5, 24-11, 24-16, 24-23, 24-34, 24-38, 24-39, 24-40, 24-41 24-44, 24-54 Shown in Maps LQ-01-053 to LQ-01-054a, Volume 5, Map Book Land quality. CSM group A sites	Key sites include: six historical landfills: Jacksons Brickworks Landfill, Windbridge Nurseries Landfill, Middle Bickenhill Lane Landfill, Brackenlands Farm Landfill and Coleshill Civic Amenity Site Landfill One operational landfill: Packington Landfill Five infilled pits and two areas of backfilled borrow pits associated with the construction of the M42 (One backfilled borrow pit listed as class 1 with the remaining sites either class 2 or 3)	Potential impact on human health on-site[69] (gas risk)	Moderate
		Potential impact on human health adjacent to the-site (gas risk)	Moderate to high
		Potential impact on groundwater quality	Moderate/low to moderate
		Potential impact on surface water quality	Moderate/low to moderate
		Potential impact on the adjacent property receptors (gas risk)	Moderate to high
		Potential impact on ecological receptors (site 24-54 only)	Moderate
24-3, 24-4, 24-9, 24-12, 24-13, 24-32, 24-36, 24-37, 24-43, 24-46, 24-58 Shown in Maps LQ-01-053 to LQ-01-054a, Volume 5, Map Book Land quality. CSM group B sites	Key sites include: the dismantled Hampton-in-Arden to Shustoke line A garage (and farm) site Park Farm Quarry Melbicks Garden and Leisure centre and three farms Rugby to Birmingham line and Birmingham International station A former Smithy Birmingham Business Park Operational Highways Agency depot (all sites either class 1 or 2)	Potential impact on human health on-site	Very low to low
		Potential impact on human health adjacent to the site	Very low to low
		Potential impact on groundwater quality	Low to moderate/low
		Potential impact on surface water quality	Low to moderate/low
		Potential impact on property receptors	Low
		Potential impact on ecological receptors (site 13 only)	Low
24-56 Shown in Map LQ-01-054a, Volume 5, Map Book Land quality. (CSM group C sites)	Infilled gravel pit (class 2 use)	Potential impact on groundwater quality	Moderate/low
		Potential impact on surface water quality	Moderate/low
No Group D sites have been identified in the study area	NA	NA	NA

[67] Each site is assigned an unique identification number (See Volume 5: Appendix LQ 001-024)
[68] The moderate or high 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.
[69] For CSM groups A and B, on-site means within the potential contaminated site identified under the "Area reference" column

Temporary effects

8.4.15 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 determine the change in the level of risk at 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 deemed 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.

8.4.16 Table 12 presents the summary of the resulting construction effects. The details of these comparisons are presented in Volume 5: Appendix LQ-001-024.

Table 12: Summary of temporary (construction) effects

Area reference[70]	**Main baseline risk**	**Main construction Risk**[71]	**Temporary effect and significance**
24-1, 24-2, 24-5, 24-11, 24-16, 24-23, 24-34, 24-38, 24-39, 24-40, 24-41, 24-44, 24-54 Shown on: Maps LQ-01-053 to LQ-01-054a, Volume 5, Map Book Land quality CSM group A sites	Potential impact on human health on-site (gas risk) = Moderate	Moderate	Negligible (N)
	Potential impact on human health off-site (gas risk) = Moderate to high	Moderate to high	Negligible (N)
	Potential impact on groundwater quality = Moderate/low to moderate	Moderate/low to moderate	Negligible (N)
	Potential impact on surface water quality = Moderate/low to moderate	Moderate/low to moderate	Negligible (N)
	Potential impact on property receptors (gas risk) = Moderate to high	Moderate to high	Negligible (N)
	Potential impact on ecological receptors (site 24-54 only) = Moderate	Moderate	Negligible (N)
24-3, 24-4, 24-9, 24-12, 24-13, 24-32, 24-36, 24-37, 24-43, 24-46, 24-58 Shown on Maps LQ-01-053 to LQ-01-054a, Volume 5, Map Book Land quality CSM group B sites	Potential impact on human health on-site = Very low to low	Very low to low	Negligible (N)
	Potential impact on human health off-site = Very low to low	Very low to low	Negligible (N)
	Potential impact on groundwater quality = Low to moderate/low	Low to moderate/low	Negligible (N)
	Potential impact on surface water quality = Low to moderate/low	Low to moderate/low	Negligible (N)
	Potential impact on property receptors = Low	Low	Negligible (N)

[70] See Table 11 for site names.

[71] The low/moderate main construction risk identified in the above table does not necessarily imply an unacceptable risk. The high risks identified reflect the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported high risk in the absence of site investigation a precautionary, worst case risk is reported in the table. Application of the processes and measures within the CoCP will ensure that site risks during the construction stage are controlled.

	Potential impact on ecological receptors (site 13 only) = Low	Low	Negligible (N)
24-56 Shown on Map LQ-01-054a, Volume 5, Map Book Land quality, CSM group C sites	Potential impact on groundwater quality = moderate/low risk	Moderate/low risk	Negligible (N)
	Potential impact on surface water quality = moderate/low risk	Moderate/low risk	Negligible (N)

8.4.17 Table 12 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, and therefore that significant effects will not occur during the construction phase.

8.4.18 There may, however, still be temporary minor offsite adverse effects during the construction period particularly from ground disturbance in areas of direct cut through historic landfills. For example, there are two landfills where the route of the Proposed Scheme will cross the landfill in cutting: Jacksons Brickworks Landfill (Diddington cutting) and Middle Bickenhill Lane Landfill (Bickenhill cutting). In addition, roads, car parking and drainage channels are proposed within the footprint of Middle Bickenhill Lane Landfill. Undergrounding of the Western Power high-voltage power line in a small section of Brackenlands Farm Landfill is also likely to result in cutting into landfill material. Consequently, earthworks could include excavation and remediation of landfill material during construction and possibly gas and/or leachate control systems to prevent ingress affecting the Proposed Scheme or to control migration external to the works where pathways have been affected by the construction.

8.4.19 The Birmingham Interchange station main site compound will include the storage of potentially hazardous substances, such as fuels and lubricating oils. The main compound and the satellite construction compounds may also be used for temporary storage of potentially contaminated soils. The measures outlined in the draft CoCP will manage risks from the storage of such materials.

8.4.20 No temporary cumulative effects have been identified for this section of the route.

Permanent effects

8.4.21 Baseline and post-construction CSM have been compared to assess the permanent (post-construction) effects.

8.4.22 Table 13 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-001-024.

Table 13: Summary of permanent (post-construction) effects

Area ref[72]	Main baseline risk	Main post-construction risk[73]	Post-construction effect and significance
24-1, 24-2, 24-5, 24-11, 24-16, 24-23, 24-34, 24-38, 24-39, 24-40, 24-41, 24-44, 24-54 Shown on Maps LQ-01-053 to LQ-01-054a, Volume 5, Map Book Land quality. CSM group A sites	Potential impact on human health on-site (gas risk) = Moderate	Moderate/low to moderate	Negligible to minor beneficial (N)
	Potential impact on human health off-site (gas risk) = Moderate to high	Moderate/low to moderate	Minor beneficial (N)
	Potential impact on groundwater quality = Moderate/low to moderate	Very low to moderate/low	Minor (N) to moderate beneficial (Y)
	Potential impact on surface water quality = Moderate/low to moderate	Very low to moderate/low	Minor (N) to moderate beneficial (Y)
	Potential impact on property receptors (gas risk) = Moderate to high	Moderate/low to moderate	Minor beneficial (N)
	Potential impact on ecological receptors (site 24-54 only) = Moderate	Moderate	Negligible (N)
24-3, 24-4, 24-9, 24-12, 24-13, 24-32, 24-36, 24-37, 24-43, 24-46, 24-58 Shown on Maps LQ-01-053 to LQ-01-054a, Volume 5, Map Book Land quality CSM group B sites	Potential impact on human health on-site = Very low to low	Very low	Negligible to minor beneficial (N)
	Potential impact on human health off-site = Very low to low	Very low	Negligible to minor beneficial (N)
	Potential impact on groundwater quality = Low to moderate/low	Low to moderate/low	Negligible (N)
	Potential impact on surface water quality = Low to moderate/low	Low to moderate/low	Negligible (N)
	Potential impact on property receptors = Low	Very Low	Minor beneficial (N)
	Potential impact on ecological receptors (site 13 only) = Low	Very Low	Minor beneficial (N)
24-56 Shown on Map LQ-01-054a, Volume 5, Map Book Land quality CSM group C sites	Potential impact on groundwater quality = Moderate/low risk	Moderate/low risk	Negligible (N)
	Potential impact on surface water quality = Moderate/low risk	Moderate/low risk	Negligible (N)

8.4.23 The magnitude of the permanent effects and their significance has 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 deemed to remain as high. This will be the case where

[72] See Table 11 for site names

[73] 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 within acceptable limits as agreed with the appropriate regulator.

the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.

8.4.24 Table 13 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.

8.4.25 Table 13 indicates that following remediation for sites which are located fully or partially in the area required to construct the Proposed Scheme (CSM Group A and B sites) there will generally be overall negligible to minor beneficial effects. Depending on the type of remediation undertaken the beneficial effect could include an improvement in groundwater quality or reduction in risk to human health as a result of removal of contaminated material or the breaking of gas migration pathways.

8.4.26 Negligible effects will result at sites where no remediation is likely to be required or will only occur to a small proportion of the potential contamination source area, and therefore, the risks are unlikely to alter significantly from the baseline assessment.

8.4.27 Sites where remediation is minimal or not required may include those which are not found to contain significant contamination, sites which are only partially situated within the area of the Proposed Scheme or sites where no significant earthworks are proposed (such as at Coleshill Civic Amenity Site Landfill where the majority of the landfill is located outside of the Proposed Scheme). Remediation occurring over a larger proportion or all of the potential contamination source area, resulting in removal of source pathway receptor linkages or a reduction in the contaminant source, will result in a minor or moderate beneficial effect compared to the baseline. Sites which require a greater amount of remediation will be those sites found to contain significant levels of contamination and/or sites where significant earthworks or sensitive end uses are proposed.

8.4.28 Additional site-specific remediation measures will be developed at the detailed design stage if required. These measures will ensure that risks to people and property from gas and vapours in the ground will be controlled to an acceptable level.

8.4.29 For sites which are located outside of the area required to construct the Proposed Scheme (CSM Group C and D sites), it is assumed that no remediation will be undertaken in these areas and therefore the effects are assessed to be negligible.

8.4.30 No permanent cumulative effects have been identified for this section of the route.

Mining/mineral resources

8.4.31 Construction of the Proposed Scheme has the potential to impact existing mineral resources and proposed areas of mineral exploitation. This could occur by sterilisation of the resource, direct excavation during construction of the Proposed Scheme or through temporary and/or permanent severance[74] that may occur during the construction phase of the Proposed Scheme, possibly continuing through to the operation.

[74] 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

8.4.32 All effects on mining and mineral sites are permanent effects. There are no purely temporary effects (such as effects from temporary use of mineral sites as construction compounds).

Permanent effects

8.4.33 The Proposed Scheme will cover the majority of the MSA between the A45 Coventry Road and the A452/A446 roundabout over the M42.

8.4.34 Two large backfilled borrow pits resulting from the construction of the M42 are located in the west of the MSA (see Map LQ-01-053, Site IDs 24-16 and 24-34, Volume 5, Map Book Land quality) and therefore there are unlikely to be any exploitable sand and gravel deposits in this part of the MSA. To the north of Park Farm Quarry the Proposed Scheme will be located across the northern part of the MSA on a mixture of embankment and cutting (Bickhenhill cutting and Packington embankment). Table 14 presents the assessment of effects from construction on the mining and mineral resources identified. The effects from the construction of the scheme in this are considered to be minor adverse.

8.4.35 The land to the east of the boundary between Solihull and Warwickshire is also designated as a MSA for sand and gravel extraction. Some road works are proposed in this area (including widening of the A452 Chester Road, a new station exit link road to the A452 Chester Road, new A452 Chester Road and A446 Stonebridge Road link roads for the new A452/A446 roundabout and works to M6 junction 4). Four balancing ponds (three adjacent to the A452 Chester Road and one adjacent to the A446 Stonebridge Road) will also be constructed, however the extent of earthworks within the MSA will be limited. Table 14 presents the assessment of effects on this mining resource. The effect is assessed to be negligible. The risks to the sand and gravel and building stone mineral MSAs to the north of the M6 are detailed in Volume 2, CFA Report 19, Coleshill Junction (CFA Report 19), Section 8.4.

Table 14: Summary of effects for mining and mineral resources

Site Name	Status	Description	Sensitivity /value	Magnitude of impact	Effect Significance? (Y/N)
Park Farm Quarry	Planning permission granted. Quarrying underway	A site with planning permission for mineral extraction and landfill (with inert waste)	High	Minor (majority of working to be complete by commencement of construction in 2016)	Minor adverse (N)
Land Between M42, A45 Coventry Road and A452 Chester Road	MSA	MSA for sand and gravel extraction	Moderate	Moderate	Minor adverse (N)
Warwickshire Mineral Safeguarding Area	MSA	MSA for sand and gravel extraction	Moderate	Negligible	Negligible (N)

Geo-conservation sites

8.4.36 No geo-conservation areas such as SSSI or LGS were identified within the study area.

Other mitigation measures

8.4.37 No additional mitigation measures are considered necessary at this stage to mitigate risks from land contamination at construction stage beyond those set out in the draft CoCP and instigated as part of required remediation strategies. In addition to the excavation and treatment of contaminated soils, it may also be necessary to install gas and leachate control systems within affected old landfill sites on a temporary or permanent basis, in order to ensure that gas and leachate migration pathways are controlled and do not adversely affect the Proposed Scheme or the wider environment.

8.4.38 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 SMBC and any other interested parties to assist in achieving an effective management of minerals within the affected location of the MSA. For example; mitigation of effects at Park Farm Quarry (also known as Stonebridge Quarry) could include liaison with the operators to allow as much time as possible to complete mineral extraction at the site.

Summary of likely significant residual effects

8.4.39 With the application of the mitigation measures detailed in Section 8.4, no likely significant residual effects are anticipated.

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. Spillage and pollution response procedures similar to those outlined in the draft COCP will be established for all high-risk activities and employees will be trained in responding to such incidents.

Assessment of impacts and effects

8.5.3 A maintenance depot for the people mover is proposed within this area. This depot will be located to the south of the proposed Birmingham Interchange station, north of the A45 Coventry Road. Potentially hazardous materials will be stored at the depot associated with maintenance and cleaning activities. In the event of any uncontrolled release of these materials, either from storage areas or during handling, contamination of the ground may occur. The magnitude of impact will depend on the type of material released, as well as the quantity and timing of the release and the sensitivity of the receiving environment. The nearest receptors to the people mover depot will be site workers and the bedrock Secondary B aquifer. Hollywell Brook is located approximately 230m north of the proposed people mover depot thus reducing

the potential impact to this receptor from accidental spills and leaks. The greatest potential impacts would arise from large-scale, uncontained releases of materials with a high toxicity and that are resistant to degradation. The likelihood of this impact arising will however be minimised through the adoption of appropriate environmental management procedures, including spillage and pollution response measures and therefore it is considered unlikely that accidental spills and leaks at the people mover depot will result in significant adverse effects.

8.5.4 There is one auto-transformer station located to the north of the new A452 /A446 roundabout. An auto-transformer station can, in principle, be a source of contamination through accidental discharge or leaks of coolants. However the proposed auto-transformer station, in common with other modern substations, will use secondary containment appropriate to the level of risk.

8.5.5 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.

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

Other mitigation measures

8.5.7 No other mitigation measures are expected to be required beyond what has already been outlined relating to land quality in the study area.

8.5.8 There may be on-going 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 significant residual effects

8.5.9 No significant residual 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 (LCA) and visual receptors.

9.1.2 In this section, the operational assessment section refers not just to the running of the trains but also to 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 LCA and visual receptors during construction, principally in the vicinity of the proposed Birmingham Interchange station, arising from the presence of construction plant and construction compounds, removal of existing vegetation and the introduction of new landform, highway modifications, built forms and lighting; and
- permanent landscape and visual effects during operation arising from the introduction of large scale built development in the vicinity of Birmingham Interchange station, including the station building itself, associated car parks, and the people mover and people mover depot. Effects will also arise from the intensification of the highway network to provide access to the new station.

9.1.4 A separate but related assessment of effects on the setting of heritage assets is included in cultural heritage (Section 6). Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in Volume 5: Appendix LV-001-024 which comprises the following parts:

- 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 Solihull Metropolitan Borough Council (SMBC). Summer field surveys, including photographic studies of LCA 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 February 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-001-000/1) and

the SMR Addendum (Volume 5: Appendix CT-001-000/2). 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, Map Book – Landscape and visual assessment, Maps LV-07-080b to LV-07-083a and LV-08-080b to LV-08-083a, Volume 2, CFA24 Map Book. 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 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 LCA and visual receptors within approximately 1km of the Proposed Scheme have been assessed. Long distance views of up to 2km have been considered at some locations such as the vicinity of Little Packington and Bickenhill.

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 The study area lies within gently undulating land to the north and west of the meandering River Blythe valley, and south and west of the River Cole valley. The valleys are indistinct and defined in part by the contrast with the ridgeline on which the village of Coleshill is situated. The ridgeline, which marks the valley side is undulating and creates a varied topography within the wider valley context. Landform within the urban area of Chelmsley Wood and over the National Exhibition Centre (NEC) complex and Birmingham Airport has been both modified and flattened.

9.3.2 The area is defined by extensive agricultural land within which the transport corridors of the M42, M6/M6 Toll, A45 Coventry Road, A446 Stonebridge Road and the A452 Chester Road, are dominant elements. In the northern part of the study area, land use is increasingly more urban, comprising a mixture of commercial development, the NEC complex, Birmingham Airport, Birmingham International station and Birmingham Business Park. Chelmsley Wood forms the main residential development.

9.3.3 The landscape character areas have been determined with reference to the Warwickshire Landscapes Guidelines[75], The North Warwickshire Landscape Character Assessment[76] and the Solihull Countryside Strategy[77].

9.3.4 Descriptions of all LCA are provided in Volume 5: Appendix LV-001-024. For the purposes of this assessment the study area has been sub-divided into seven discrete LCA, three of which are most likely to be affected and described below. A summary of these LCA is provided below. The LCA are shown on Maps LV-02-080b to LV-02-083a, Volume 5, Map Book Landscape and visual.

M42 corridor LCA

9.3.5 The character of this area is dominated by the M42 and associated infrastructure which has led to a pattern of severed fields and reduced tranquillity. The area either side of the motorway is characterised by an enclosed, gently rolling landscape defined by woodland edges, parkland and belts of trees. The landscape is generally in a good condition, and although levels of tranquillity are low, it appears to be a landscape enjoyed and valued by local residents as evidenced by a well-used footpath in close proximity to residences. Principally due to influences on tranquillity and character from the M42, this area has a low sensitivity to change (see Map LV-02-081 and Map LV-02-082a, Volume 5, Map Book Landscape and visual).

Solihull rural heartland LCA

9.3.6 This well-wooded farmland landscape with rolling landform, an ancient pattern of small fields, winding lanes and dispersed hamlets is in good condition. It provides a rural setting for long established and often attractive villages including Hampton-in-Arden. Fields are mainly arable and bounded by woodland edges, tree belts and wooded streams. Incongruous elements include large-scale mineral workings and golf courses. The area is crossed by a number of major transport routes, including the A45 Coventry Road and the A452 Chester Road, which reduce tranquillity locally. This LCA is of local value, due to the contrast it provides to neighbouring urban areas, and has a medium sensitivity to change (see Map LV-02-080b and Map LV-02-081, Volume 5, Map Book Landscape and visual).

Chelmsley Wood LCA

9.3.7 Chelmsley Wood is a residential area of predominantly 1960s and 1970s medium density housing, with ancillary facilities such as recreational and shopping areas. The urban/suburban area is relatively busy with traffic and pedestrian activity, with a medium level of tranquillity overall. The open spaces created as part of the development, are well established and therefore it is largely of local value to residents only. Therefore, this area has a medium sensitivity to change (see Map LV-02-082a, Volume 5, Map Book Landscape and visual).

[75] Warwickshire County Council (1993), *Warwickshire Landscapes Guidelines*; http://www.warwickshire.gov.uk/landscapeguidelines; Accessed: June 2013.
[76] North Warwickshire Borough Council (2010), *North Warwickshire Landscape Character Assessment*; http://www.northwarks.gov.uk/site/scripts/download_info.php?downloadID=1668; Accessed: June 2013.
[77] Solihull Metropolitan Borough Council (2010), *Solihull's Countryside Strategy: First Review 2010 – 2020* ; www.solihull.gov.uk/Attachments/countsidestrat_firstrev.pdf; Accessed: June 2013.

Cole Valley LCA

9.3.8 The extent of the Cole valley LCA within the study area is limited to an isolated area to the west of the M6 and north of Chelmsley Wood.

9.3.9 The majority of the LCA is located within Coleshill Junction (CFA19). For the summary baseline description refer to Volume 2 CFA 19, and for the full baseline description refer to Volume 5 CFA 19.

Visual baseline

9.3.10 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-024. A summary description of the distribution and types of receptors most likely to be affected is provided below. The viewpoints are shown on: Maps LV-07-080b to LV-07-083a and LV-08-080b to LV-08-083a, Volume 2, CFA24 Map Book. 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.

9.3.11 No protected views have been identified within the study area.

9.3.12 Residential receptors have a high sensitivity to change and are located on the northern edges of Hampton-in-Arden, along Middle Bickenhill Lane and within Chelmsley Wood. In addition, isolated groups of properties are located throughout the study area. Views are typically rural across pasture or agricultural fields defined by hedgerows. The highways and infrastructure within the area, including the M42, are regularly present in the middle to background of views (see: Map LV-07-080b to LV-07-083a, Volume 2, CFA24 Map Book).

9.3.13 Recreational receptors, also with a high sensitivity to change, are located on public rights of way (PRoW) in the wider landscape. The viewpoints are typically located in rural agricultural locations, with pasture fields forming the foreground and wooded skylines or planted field boundaries forming some degree of enclosure (see Maps LV-07-080b to LV-07-083a, Volume 2, CFA24 Map Book).

9.3.14 Viewpoints representative of views obtained by people travelling along main roads are located on Middle Bickenhill Lane, the A452 Chester Road, Solihull Parkway, A446 Stonebridge Road, Coleshill Heath Road and the A45 Coventry Road and have a low sensitivity to change. These views are characterised by arable farmland and grazing pasture, with wooded backdrops and hedgerows along field boundaries (see Maps LV-07-080b to LV-07-083a, Volume 2, CFA24 Map Book).

Future baseline

9.3.15 A summary of the committed developments which are assumed to be mostly 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, : Appendix CT-004-000 and Maps CT-13-053 to CT-13-054a-L1, Volume 5, Map Book Committed consents and development allocations.

Construction (2017)

9.3.16 Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017. Two developments have been considered in relation to effects on landscape character and nature of views. These developments are shown on Map series CT-13-053 to CT-13-054a-L1, Volume 5, Map Book Committed consents and development allocations, and are:

- full planning application (2011/1959) for sand and gravel extraction at Park Farm, A452 Chester Road; and
- outline planning application (2011/1159) for mixed-use leisure/entertainment complex at north and east of Pendigo Way.

9.3.17 It is considered that there will be no change to the baseline which will introduce new or remove existing significant effects.

Operation (2026)

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

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, structure works and construction of Birmingham Interchange station. The effects associated with the peak construction phase in this area will generally be considered to be long term given the construction programme (see Section 2.3). Overall, civil engineering works in this area will be undertaken between the start of 2017 and the start of 2023. The Birmingham Interchange station main compound will be in place for approximately five years and six months. Satellite compounds will be in place for between approximately one year and six months and five years and six months 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.

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

- the A45 Coventry Road overbridge and associated highway modifications and modifications to Stonebridge Island;
- construction of the route and overhead line equipment, Birmingham Interchange station main compound, logistics and storage satellite compound,

lighting at construction compounds, demolition of roundabouts, structures and buildings.

- the proposed Birmingham Interchange station and associated infrastructure, including Hollywell Brook underbridge, the people mover and people mover depot, highway accesses and car parks;
- A452 Chester Road widening and realignment;
- modification to the M42;
- widening of the M6 junction 4 roundabout;
- A452 link road overbridge;
- M42 motorway viaduct;
- Pool Wood embankment between M6 junction 4 and Coleshill Heath Road;
- loss of part of Heath Park and effects on the views of users due to the presence of the Coleshill Heath Road underbridge satellite compound;
- Coleshill Heath Road underbridge;
- M6 motorway box structure; and
- general earthworks along the Proposed Scheme requiring cut/fill, vegetation removal, modification of landform and the presence of construction plant and temporary soil storage mounds.

Avoidance and mitigation measures

9.4.3 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):

- 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);
- maximising the retention and protection of existing trees and vegetation where possible (draft CoCP, Section 12);
- 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
- management of flood risk and other extreme weather events which may affect landscape and visual assessment resources during construction (draft CoCP, Section 16).

9.4.4 These measures have been taken account of in the assessment of the construction effects below.

Assessment of temporary impacts and effects

9.4.5 The most apparent changes to landscape character and viewpoints during construction will relate to the temporary presence of construction plant and construction compounds, removal of existing landscape elements, such as trees and hedges, and introduction of new large-scale landforms and built development most notably around the proposed Birmingham Interchange station and Chelmsley Wood. Changes will be particularly apparent due to the close proximity of construction activities to viewpoints, coupled with the absence of intervening screening.

9.4.6 Further effects will arise from soil storage mounds, for example in the vicinity of Middle Bickenhill Lane; between the A452 Chester Road and A446 Stonebridge Road; and the M42. The Birmingham Interchange station main compound, Birmingham Interchange temporary workers accommodation satellite compound, logistics and storage satellite compound, concrete batching plant and precast storage compound (aggregates, structural steel, steel reinforcement), and areas of temporary materials stockpile surrounding Middle Bickenhill Lane will be large scale and will introduce additional visual intrusion within the study area. In certain locations, landform 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 LCA during construction. All LCA within the study area considered to experience a non-significant effect (minor adverse or negligible) are described in Volume 5: Appendix LV-001-024.

M42 corridor LCA

9.4.8 Construction activity will be focused within the area to the north of Middle Bickenhill Lane, crossing the site of the Olympia Motorcycle Track and continuing beyond the point at which the Proposed Scheme will cross the M6 adjacent to Coleshill. Construction activities will include large-scale earthworks, the removal of the motorcycle track and the severance and fragmentation of numerous fields including the removal of hedgerows and mature trees. Activity associated with infrastructure at Birmingham Interchange station, including construction of car parks and highway modifications will largely fall in the adjacent LCA, but will influence the setting of the M42 corridor LCA. Within the LCA the temporary presence of the Birmingham Interchange station main compound, workers accommodation, logistics and storage area, concrete batching plant and precast storage area, and areas of temporary materials stockpile located adjacent to the M42 will be locally very prominent. Construction will reduce tranquillity within the area. The removal of hedgerows will further fragment the existing field pattern and the scale of construction activity will extensively increase the urbanisation of this LCA. Therefore, the magnitude of change is considered to be high. The high magnitude of change, assessed alongside the low sensitivity of the character area, will result in a moderate adverse effect.

Solihull rural heartland LCA

9.4.9 Construction of the Proposed Scheme will occur from Pasture Farm, located within Balsall Common and Hampton-in-Arden (CFA23), to the south of the A45 Coventry Road through to Middle Bickenhill Lane to the north of Park Farm.

9.4.10 Construction will require the removal of characteristic landscape elements such as trees, hedgerows and will cause the severance and fragmentation of agricultural fields. The character of the area will be directly affected by the presence of temporary incongruous elements in the rural landscape, large-scale earthworks and construction plant. Construction activity will occur at the A45 Coventry Road overbridge, A45 Service Road overbridge and East Way overbridge, Birmingham Interchange station, Hollywell Brook underbridge, the people mover and people mover depot, and modifications to Stonebridge Island and the revised access to the National Motorcycle Museum. Construction activity will introduce vehicles and lighting, reducing tranquillity locally for the duration of the works. Overall, these changes will be confined to a relatively small part of the LCA which is already degraded by National Grid overhead power lines and highways within the urban fringe, and therefore the magnitude of change is considered to be medium.

9.4.11 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Chelmsley Wood LCA

9.4.12 The construction of the Proposed Scheme will be located across the edge of the LCA through Heath Park. This area of public open space incorporates football pitches adjacent to the larger Bluebell Recreation Ground which comprises playing fields and a play area adjacent to Yorkminster Drive. Construction activity associated with the Coleshill Heath Road underbridge will result in the temporary severance of Coleshill Heath Road, in addition to loss of open space at Heath Park. Impacts on landscape character will also relate to substantial earthworks, construction activity and the presence of construction plant and some removal of vegetation. Tranquillity will be affected by the presence of construction plant including those required to construct the M6 motorway box structure, Coleshill No.1 embankment (located in Coleshill Junction (CFA19) and Pool Wood embankment, and movement of excavated materials, in close proximity to Chelmsley Wood residential area. Although there will be an extensive presence of construction plant and an area of public open space will be removed from use, the majority of the area will be largely unaffected and the magnitude of change is considered to be medium.

9.4.13 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Cole Valley LCA

9.4.14 The majority of this LCA is located within CFA 19. For the assessment of temporary effects during construction refer to Volume 2 Coleshill Junction (CFA 19).

Visual assessment

9.4.15 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-001-024.

9.4.16 The number identifies the viewpoint locations which are shown on Maps LV-07-080b to LV-07-083a and LV-08-80b to LV-08-083a, Volume 2, CFA24 Map Book. 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.

9.4.17 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.

Viewpoints 299.2.005 and 299.2.006: views north and south-east along Middle Bickenhill Lane from Elm Gables and Meadow Cottage residences

9.4.18 Construction plant and activities, such as earthmoving and the works at Birmingham Interchange station, Hollywell Brook underbridge, the people mover and people mover depot, and to a lesser extent the A45 Coventry Road overbridge, A45 Service Road overbridge and East Way overbridge will be widely visible to the east, from ground and first floor levels. Workers accommodation, logistics and storage satellite compound, and areas of temporary materials stockpile will be visible to the west. As a consequence, the magnitude of change is considered to be high.

9.4.19 The high magnitude of change assessed alongside the high sensitivity of these receptors will result in a major adverse effect.

9.4.20 At night, continuous lighting is proposed at the Birmingham Interchange station main compound and Birmingham Interchange temporary workers accommodation satellite compound. The relatively unlit baseline context at this location will mean that lighting impacts at night will be of medium magnitude and result in an effect of moderate adverse significance (see Map LV-07-081, E7, Volume 2, CFA24 Map Book).

Viewpoint 299.4.002: view east along East Way from Middle Bickenhill Lane bridge

9.4.21 Views will be characterised by activity associated with the construction of embankments to accommodate the realigned East Way and A45 Coventry Road, which will be raised up to 4m in the middle ground. Construction plant, including tall cranes required to construct the A45 Coventry Road overbridge and East Way overbridge, will be prominent within the centre of the view. The prominence of these features will be further increased through the removal of roadside vegetation in the middle ground. Construction traffic and the removal of vegetation will also be apparent within the panorama, associated with highway infrastructure and excavation of balancing ponds. As a consequence, the magnitude of change is considered to be medium.

9.4.22 The medium magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-081, D8, Volume 2, CFA24 Map Book).

Viewpoint 299.4.003: view north-east across Middle Bickenhill farmland from footpath parallel to East Way

9.4.23 Extensive construction activities associated with the Proposed Scheme will be visible in the middle to background of this view, above an area of temporary materials stockpile in the foreground. Tall construction plant associated with the Birmingham Interchange station will be visible against the backdrop of the Packington Landfill site and the skyline in the centre of the view. The realignment of Hollywell Brook and the construction of the people mover and people mover depot will also introduce tall construction plant into the view. There will also be partially screened views of the excavation of balancing ponds and earth moving equipment in the middle ground. Therefore, the magnitude of change is considered to be high.

9.4.24 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-081, E8, Volume 2, CFA24 Map Book).

Viewpoint 299.4.004:view north-east over M42 along East Way from East Way loop underbridge

9.4.25 The Birmingham Interchange station temporary workers accommodation satellite compound will be prominent to the east of the M42. The elevation of this viewpoint will afford views of construction of the Birmingham Interchange station, which will be prominent within the background of the view. Views of the construction of the people mover across the M42 corridor will dominate the middle ground. Although intervening vegetation running parallel with the route of M42 will filter views of lower sections of this construction activity, it will be viewed in the context of the motorway corridor which dominates the foreground, and therefore the magnitude of change is considered to be high.

9.4.26 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-081, D7, Volume 2, CFA24 Map Book).

Viewpoint 302.4.001: view south-west across pasture from the A452 Chester Road

9.4.27 The construction of the Birmingham Interchange station internal road network and Bickenhill cutting at up to 7m depth to the north of the Birmingham Interchange station through to the A452/A446 roundabout will dissect the foreground and middle-ground of this view. Construction activities will be prominent, encompassing and replacing the arable agricultural land in the middle ground. Temporary material stockpile areas and the Birmingham Interchange station temporary workers accommodation satellite compound will also be visible in the background of the view. Therefore, the magnitude of change in this close range view is considered to be high.

9.4.28 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-081, F4, Volume 2, CFA24 Map Book).

Viewpoint 302.4.002: view south-west across farmland from the A452 Chester Road opposite Melbicks Garden and Leisure centre

9.4.29 Construction of the A452 Chester Road realignment and widening will be prominent within the foreground and middle-ground of this view along with the M42 motorway viaduct (east) satellite compound. The removal of roadside vegetation will also expose views of construction plant in the foreground. The rising topography towards the right of the panorama will afford views of large scale construction activity associated with the M42 motorway viaduct. Therefore, the magnitude of change in this view is considered to be high.

9.4.30 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-081, F2, Volume 2, CFA24 Map Book).

Viewpoint 303.4.002: view north-east towards the A452 Chester Road roundabout from Solihull Parkway

9.4.31 Construction activity associated with the realignment of Solihull Parkway, the M42 motorway viaduct and realignment of the B4438 Bickenhill Parkway will form prominent elements in the view in the immediate foreground and middle ground. The removal of highway vegetation and the construction of the Solihull Parkway/B4438 Bickenhill Parkway roundabout and realignment and widening of the A452 Chester Road will also be visible in the background. Therefore, the magnitude of change in this view is considered to be high.

9.4.32 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-082a, E9, Volume 2, CFA24 Map Book).

Viewpoint 304.4.001: view west towards the A452 Chester Road roundabout from the diverted A446 Stonebridge Road

9.4.33 This viewpoint will be located on the realigned A446 Stonebridge Road, which will be completed in advance of the peak construction phase to enable construction of the M42 motorway viaduct and Pool Wood embankment.

9.4.34 Views will be dominated by demolition activities at the A452 Chester Road /A446 Stonebridge Road roundabout above the carriageway of the M42 in the immediate foreground of the view. Cranes and other tall construction plant associated with the construction of the M42 motorway viaduct will also be prominent in the foreground. Existing vegetation within the view will be partially removed in order to facilitate the realignment of the A446 northbound on link from the Birmingham Interchange station. Therefore, the magnitude of change in this view is considered to be high.

9.4.35 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-082a, F9, Volume 2, CFA24 Map Book).

Viewpoint 305.3.001: view north-east across farmland adjacent to the A452 Chester Road

9.4.36 The primary construction impacts on this view will result from the appearance of tall construction plant required for construction of Pool Wood embankment at this location. The route will cross broadly north-west to south-east in the middle-ground of the view. Sections of the hedgerows apparent on the horizon will be removed to accommodate the earthworks and the route. Construction plant will be more prominent in the left and central part of the view, due to the more open skyline and less vegetated backdrop. However, construction activity will be seen in the context of existing transmission towers and National Grid overhead power lines crossing the fields adjacent to the M42 corridor. Therefore, the magnitude of change in this view is considered to be medium.

9.4.37 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-082a, E6, Volume 2, CFA24 Map Book).

Viewpoint 305.2.006: view east across Bluebell Recreation Ground from residences on Bluebell Drive/Lyecroft Avenue

9.4.38 Construction activity, including cranes, will be partially visible on the skyline in the background of the view, beyond the mature line of trees, hedgerows and existing earth mounding on Yorkminster Drive, bounding the edge of the recreation ground. The view will include the construction of the M6 motorway box structure, up to 13m above existing ground level, and Pool Wood embankment approximately 10m above existing ground level. The construction of the Coleshill Heath Road underbridge will also be apparent. Views from upper floors may encompass wider construction activities, although in the distant background. Therefore, the magnitude of change is considered to be low.

9.4.39 The low magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

9.4.40 At night, temporary construction lighting will be visible in the middle ground and background of the view seen in the context of vehicle lighting on the M6/M42 and lighting on the M6 junction 4. However, given the distance and the existing lit context, the magnitude of change to this receptor at night is considered to be low, resulting in a moderate adverse effect (see Map LV-07-082a, E3, Volume 2, CFA24 Map Book).

Viewpoint 305.2.008: view north-east across open space adjacent to Yorkminster Drive from residences on Foxland Close

9.4.41 The Proposed Scheme will be located adjacent to the existing overhead electricity transmission towers in this panorama. Construction activity will be partially visible in the background of the view, above the intervening landform and planting associated with the M6 corridor. Views will include the tall cranes required for construction of M6 motorway box structure, M6 motorway south viaduct and Coleshill No. 1 embankment (located within Coleshill Junction (CFA19). Views from upper floors in the residences will be more open and other construction activity at lower levels may also be visible. Therefore, the magnitude of change is considered to be medium.

9.4.42 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-07-082a, E2, Volume 2, CFA24 Map Book).

Viewpoints 306.4.001 and 306.4.002: views south-west and west along the M6 slip road/M6 from Coleshill Heath Road underbridge and the A446 Stonebridge Road

9.4.43 The Proposed Scheme will cross the centre of the view traversing the corridor of the M6 on the M6 motorway box structure at this location, which lies immediately adjacent to the route and will be approximately 135m in length. Tall construction plant required to construct the 13m high M6 motorway box structure and Pool Wood embankment will be visible in the immediate foreground of the view, on the skyline. Although construction will be seen in the context of the existing visual detractors including the M6 corridor, overhead electricity transmission towers and high-rise buildings within Birmingham, the visual context of the viewpoint will change substantially as a result of the immediate proximity of construction activities. Therefore, the magnitude of change is considered to be high.

9.4.44 The high magnitude of change, assessed alongside the low sensitivity of these receptors, will result in a moderate adverse effect (see Map LV-07-082a, F3 and G5, Volume 2, CFA24 Map Book).

Cumulative effects

9.4.45 Section 2.1 and Volume 5: Appendix CT-004-000 and Maps CT-13-053 to CT-13-054a, L1, Volume 5, Map Book Committed consents and development allocations, 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. There are no committed 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 LCA and viewpoints.

Other mitigation measures

9.4.46 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 significant residual effects

9.4.47 As no other mitigation measures are considered practicable at this time without further third party dialogue, the temporary residual significant effects during construction will remain as described above for the M42 corridor LCA, Solihull rural heartland LCA and Chelmsley Wood LCA (illustrated on Map LV-02-080bto 083a, Volume 5, Map Book Landscape and visual) and for the identified viewpoints.

9.4.48 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:

- the Diddington cutting through the existing rural landscape to the south of the A45 Coventry Road;
- introduction of highway infrastructure including the A45 Coventry Road overbridge, A45 Service Road overbridge, East Way overbridge and modification of the East Way Loop underbridge;
- introduction of Hollywell Brook underbridge;
- permanent severance of land and introduction of extensive built development at the Birmingham Interchange station, including internal road network, car parking, and the people mover and people mover depot;
- A452 Chester Road link road overbridge adjacent to Birmingham Business Park;
- introduction of viaducts, embankments, noise fence barriers and associated highway modifications at Coleshill Heath Road underbridge, M42 motorway viaduct and the M6 motorway box structure;
- Pool Wood embankment between M6 junction 4; Coleshill Heath Road and Coleshill No. 1 embankment;
- the removal of transmission towers, relocation of transmission towers and overhead power lines; and
- the regular presence of high speed trains passing through the landscape.

Avoidance and mitigation measures

9.5.2 The operational assessment of impacts and effects is based on year 1, year 15 and year 60 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:

- replacement of lost woodland on a like for like basis, for example along areas of the A45 Coventry Road, A452 Chester Road and the dismantled Hampton-in- Arden to Shustoke line in the vicinity of Birmingham Interchange station;
- planting, including native broad-leaved woodland, shrub and hedgerows along various sections of the Proposed Scheme, to screen views from neighbouring residential properties and users of adjacent PRoW, and to aid integration of

the Proposed Scheme into the landscape. This is proposed around the A45 Coventry Road overbridge, Birmingham Interchange station and car parks and between the Birmingham Business Park and the route. Selection of species will take into account possible climate change impacts associated with the quality and availability of water and the potential increase in pests and diseases;

- marginal planting around balancing ponds will be introduced at locations around the Birmingham Interchange station to aid integration into the landscape. Balancing ponds will be integrated into the landscape to alleviate flooding and also provide opportunities for biodiversity; and
- embankment and cuttings, both for the route and highway realignments, including the road network associated with the Birmingham Interchange station, have been shaped to integrate the Proposed Scheme into the character and topography of the surrounding landscape.

9.5.3 These measures have been taken account of in the assessment of the operational effects below.

Assessment of impacts and effects

9.5.4 The likely significant effects on the landscape character and viewpoints in operation will arise from the removal of existing landscape elements and vegetation, including field boundaries in the vicinity of Birmingham Interchange station and the introduction of large scale built development including the Birmingham Interchange station, associated car parks and the people mover and people mover depot. Locally, in the vicinity of the Birmingham Interchange station, this will create a new landscape character which will effectively replace the remnant field patterns and dissected land parcels of the urban fringe with the designed large scale landscape of the Proposed Scheme. Additional effects will arise from the intensification of the road network to provide access to Birmingham Interchange station, car parks and to realign the A45 Coventry Road over the route.

Landscape assessment

9.5.5 This section describes the significant effects on landscape character areas during year 1, year 15 and year 60 of operation. Non-significant effects on landscape character areas are presented in Volume 5: Appendix LV-001-024.

9.5.6 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.

M42 corridor LCA

9.5.7 Effects on landscape character will result from the presence of large-scale earthworks such as embankments and built infrastructure within the LCA. These will include the Birmingham Interchange station, surface level car parks and highway modifications associated with the A452/A446 roundabout and M42 junction 6 along with the people mover. The permanent severance of agricultural fields will further fragment existing field patterns. As a result of the increased urbanisation of this LCA and new land uses, the magnitude of change is considered to be high.

9.5.8 The high magnitude of change, assessed alongside the low sensitivity to change of the LCA, will result in a moderate adverse effect in year 1 of operation.

9.5.9 By year 15 and 60, the elements of built infrastructure including the Birmingham Interchange station, car parks and highway modifications associated with the A452/A446 roundabout and M42 Junction 6, although partially mitigated by planting, will represent a permanent change in character and continue to result in a moderate adverse effect at year 15 and year 60.

Solihull rural heartland LCA

9.5.10 Between Pasture Farm, located in the Balsall Common and Hampton-in-Arden CFA (CFA23) and the A45 Coventry Road the route will be in cutting (Diddington cutting). To the north of the A45 Coventry Road the route will cross the narrow valley of the Hollywell Brook on an underbridge and Bickenhill embankment before entering the Birmingham Interchange station. Impacts within the LCA therefore vary considerably according to elevation of the Proposed Scheme. In areas where the route will be in cutting the effects on landscape character will include:

- engineered landforms of steep slopes of the cutting which will cut across the natural landform, incongruous in the context of the adjacent landscape;
- introduction of overhead line equipment and trains in cutting and at grade, which will be an incongruous feature in a rural context; and
- agricultural land either side of the route will be reinstated and returned to use, but severance of land will create slivers of farmland or small fields unviable for farming which create opportunities for ecological and landscape mitigation.

9.5.11 In areas where the route will be at grade, on embankment, viaduct or overbridge the effects on landscape character will include:

- engineered landforms of steep slopes associated with modifications of highways crossing the route (e.g. the A45 Coventry Road), contrasting with the natural landform;
- introduction of embankment landforms adjacent to Hollywell Brook, forming prominent man-made structures cutting across the landscape;
- introduction of large-scale built development, internal road network, the people mover and people mover depot and other infrastructure on areas at the Birmingham Interchange station; and
- introduction of noise fence barriers as a distinct linear feature, contrasting with the rural landscape.

9.5.12 The A45 Coventry Road overbridge, A45 Service Road overbridge, East Way overbridge and modification of the East Way Loop underbridge and new internal road network associated with the Birmingham Interchange station will introduce further man-made infrastructure associated with the Proposed Scheme. There will be a localised reduction in tranquillity due to the visual interruption and noise of trains in the predominantly rural context. Overall, due to the presence of these incongruous

elements in the rural landscape affecting a relatively small part of the LCA, the magnitude of change is considered to be medium in year 1 of operation.

9.5.13 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.

9.5.14 By year 15 and beyond to year 60 of operation, the maturity of planting established as part of the Proposed Scheme will result in greater landscape integration, but the scale of change to the LCA in this study area will remain of moderate adverse significance through to year 60.

Cole Valley LCA

9.5.15 The majority of this LCA is located within CFA 19. For the assessment of permanent effects during operation refer to Volume 2 CFA 19.

Visual assessment

9.5.16 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-001-024.

9.5.17 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.

9.5.18 Where significant effects have been identified, an assessment of effects at night time arising from additional lighting has also been undertaken.

9.5.19 The number identifies the viewpoint locations which are shown on Maps LV-07-080b to LV-07-083a and LV-08-080b to LV-08-083a (Volume 2, CFA24 Map Book). 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.

9.5.20 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. For some locations there are photomontages for visual receptors with non-significant effects described in Volume 5.

Viewpoints 299.2.005 and 299.2.006: views north and south-east along Middle Bickenhill Lane from Elm Gables and Meadow Cottage residences

9.5.21 The Birmingham Interchange station and associated car parking, in addition to the Hollywell Brook underbridge, and the people mover and people mover depot will be visible from these locations. Trains and the people mover will introduce movement across the view. Due to the extensive visibility of new large-scale development within the previously rural landscape, the magnitude of change is considered to be high.

9.5.22 The high magnitude of change assessed alongside the high sensitivity of these receptors will result in major adverse effects in the winter of year 1 of operation.

9.5.23 In summer, due to the limited presence of intervening woodland, effects will be unchanged.

9.5.24 At night, continuous lighting associated with the Birmingham Interchange station will be visible in the middle and background of the view. This lighting will be apparent in a previously largely unlit location with few light sources. Therefore, taking distance into account the magnitude of change is considered to be medium, giving rise to an adverse effect of moderate significance. This will remain unchanged in summer and in future assessment years.

9.5.25 By year 15 and beyond to year 60 of operation, although proposed planting will have matured, providing some screening, the elements of the Proposed Scheme will remain clearly visible beyond the planting in the middle distance. Therefore, effects will be unchanged (see: Map LV-08-081, E7, Volume 2, CFA24 Map Book).

Viewpoint 299.4.002: view east along East Way from Middle Bickenhill Lane Bridge

9.5.26 The route will be on a low embankment or within cutting at this location and will not be prominent within this view, obscured by the embankments of East Way and the A45 Coventry Road. These embankments will be evident on rising ground within the middle and background due to the elevated viewpoint and the vegetation which will have been removed during construction. Glimpsed views of overhead line equipment and passing trains may be perceptible at the left extent of the panorama associated with the route on embankment. Therefore, the magnitude of change is considered to be medium.

9.5.27 The medium magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

9.5.28 There will be limited additional screening in the summer due to the vegetation removed during construction. Therefore, the magnitude of change is considered to remain medium, giving rise to a moderate adverse effect.

9.5.29 By year 15 and beyond to year 60 of operation, the effects of proposed planting will reduce the effects on the viewpoint to non-significant (see: Map LV-08-081, D8, Volume 2, CFA24 Map Book).

Viewpoint 299.4.003: view north-east across Middle Bickenhill farmland from footpath parallel to East Way

9.5.30 Birmingham Interchange station and Hollywell Brook underbridge will be visible within the middle to background of this view. The station building will be prominent as a result of its scale and height and will obstruct wider views to the backdrop of the Packington Landfill site. The people mover will also be visible in the middle ground along with overhead line equipment on the route. The people mover depot will be within the view, although partially screened by intervening vegetation. Overall, the magnitude of change is considered to be high.

9.5.31 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect in the winter of year 1 of operation.

9.5.32 In summer of year 1 of operation, while intervening hedgerows will provide enhanced screening, the scale of the Birmingham Interchange station will mean the effects will be unchanged.

9.5.33 At night, continuous lighting associated with the Birmingham Interchange station will be visible in the middle and background of the view. This lighting will be apparent in a previously largely unlit location with few light sources. Therefore, taking distance into account the magnitude of change is considered to be medium, giving rise to an effect of moderate significance. This will remain unchanged in summer or in future assessment years.

9.5.34 By year 15 planting will partially screen elements of the Proposed Scheme. However the people mover and Birmingham Interchange Station will remain prominent in the middle ground, resulting in a medium magnitude of change and an effect of moderate adverse significance.

9.5.35 By year 60 of operation, the growth and maturity of proposed planting will provide substantial screening of the Proposed Scheme, meaning effects on this viewpoint will be non-significant. This is reported in Volume 5: Appendix LV-001-024 and shown on Map LV-08-081, E8,Volume 2, CFA24 Map Book.

Viewpoint 299.3.004: View north-east over M42 along East Way from East Way Loop underbridge

9.5.36 The elevation of the viewpoint will afford views of the Birmingham Interchange station, which will be prominent within the background of the view. Views of the people mover crossing the M42 corridor will dominate the middle ground. Intervening vegetation running parallel with the route of M42 will partially filter views of the car parking and of lower sections of the Birmingham Interchange station. Overhead line equipment will also be visible in the middle ground. Therefore, the magnitude of change to the view will be high.

9.5.37 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in moderate adverse effects in the winter of year 1 of operation.

9.5.38 In summer the hedgerow along the footpath will offer greater screening value but views through gaps in it will mean that the magnitude of change to the view will remain high. By year 15 planting will partially screen the people mover depot and soften the façade of Birmingham Interchange station as well as reduce views of the car parks. However, due to the elevated nature of the viewpoint, the people mover and Birmingham Interchange station will remain prominent in the middle ground, resulting in a medium magnitude of change and an adverse effect of moderate significance.

9.5.39 By year 60 of operation, the growth and maturity of proposed planting will substantially screen Birmingham Interchange station, car parks and the people mover depot. The people mover crossing the M42 will remain a prominent element in the middle ground but viewed in the context of the M42 corridor. Effects on this viewpoint

at year 60 will not be significant. This is reported in Volume 5: Appendix LV-001-024 and shown on Map LV-08-081, D7, Volume 2, CFA24 Map Book.

Viewpoint 302.4.001: view south-west across pasture from the A452 Chester Road

9.5.40 The embankment accommodating the A452 Chester Road/A446 northbound on link will be visible in the middle ground beyond a new balancing pond. The route will emerge from Bickenhill cutting to run at grade and the highway embankment accommodating the A452 Chester Road/A446 northbound on link will screen lower sections of it. However, the overhead line equipment will be visible above, against the skyline. Glimpsed views towards the realigned section of the A452 Chester Road approaching the A452/A446 roundabout will also be possible, although these will be limited by the rising topography. Highway elements and the route dominate the foreground at a distance of approximately 80m and will also be prominent in the middle ground. Therefore, the magnitude of change is considered to be high.

9.5.41 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.42 In summer, due to the scarcity of intervening vegetation, effects will be unchanged.

9.5.43 By year 15 and beyond to year 60 of operation, the growth and maturity of proposed planting will substantially screen the route as it leaves Bickenhill cutting, obscuring longer views, meaning effects on this viewpoint will not be significant. This is reported in Volume 5: Appendix LV-001-024 and shown on Map LV-08-081, F4 (Volume 2, CFA24 Map Book).

Viewpoint 302.4.002: View south-west across farmland from the A452 Chester Road opposite Melbicks Garden and Leisure centre.

9.5.44 In winter of year 1 Packington embankment and trains will dominate the foreground of the view given the proximity of the viewpoint to the route and lack of intervening vegetation. Although the 5m embankment will partially screen the A452 link road overbridge in the middle-ground, the magnitude of change is considered to be high.

9.5.45 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-08-081, F2, Volume 2, CFA24 Map Book).

9.5.46 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-171, Volume 2, CFA24 Map Book.

9.5.47 In summer year 1 planting will remain immature and the nature of change in the view will be that described for winter.

9.5.48 By year 15 and beyond to year 60 of operation, the growth and maturity of proposed planting in the foreground will substantially screen the Packington embankment meaning effects on this viewpoint will not be significant, although long views will be obstructed. This is reported in Volume 5: Appendix LV-001-024 and shown on Map LV-08-081, F4, Volume 2, CFA24 Map Book.

Viewpoint 303.4.002: View north-east towards A452 Chester Road roundabout from Solihull Parkway.

9.5.49 The realigned Solihull Parkway will be present in the foreground with the new A452 Chester Road/B4438 Bickenhill Parkway roundabout in the middle ground, behind which the M42 viaduct and Pool Wood embankment will be prominent. The magnitude of change in this view in year 1 is considered to be high.

9.5.50 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-08-082a, E9, Volume 2, CFA24 Map Book).

9.5.51 In summer the absence of intervening vegetation and immaturity of planting, means the magnitude of change in this view will remain high.

9.5.52 By year 15 and beyond to year 60 of operation, the view will remain open and comprise the realigned Solihull Parkway and A452 Chester Road/B4438 Bickenhill Parkway roundabout with the M42 viaduct and Pool Wood embankment beyond, in the middle ground. The magnitude of change in the view will remain high, which, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect in year 15 and year 60.

Viewpoint 304.4.001: View west towards A452 Chester Road roundabout from the diverted A446 Stonebridge Road.

9.5.53 The description of visual effects in operation is based on the slightly repositioned/relocated viewpoint location on the A446 northbound on link road. In year 1, views will be dominated by the M42 motorway viaduct and the Pool Wood embankment in the foreground of the view. The viaduct and maximum 8m height of the Pool Wood embankment, with overhead line equipment (8m height) and trains above it, will be dominant in the view. Therefore, the magnitude of change in this view is considered to be high.

9.5.54 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect (see Map LV-08-082a, F9, Volume 2, CFA24 Map Book).

9.5.55 In summer the absence of intervening vegetation and immaturity of planting, means the magnitude of change in this view will remain high.

9.5.56 By year 15 and beyond to year 60 of operation, the M42 viaduct and the Pool Wood embankment will remain a dominant element in close proximity. The magnitude of change in the view will remain high, which, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect in year 15 and year 60.

Viewpoint 305.3.001: view north-east across farmland adjacent to the A452 Chester Road

9.5.57 This view is perpendicular to the direction of travel on the A452 Chester Road, the route lying approximately 175m from the viewpoint. The route will be on the Pool Wood embankment and in false cutting at this location, crossing the rising topography of the middle-ground. However gaps in the continuation of this boundary and the removal of some field boundaries in the middle-ground will afford some direct

views of the route. Although the false cutting landform will screen trains, overhead line equipment will be visible above, against the skyline. Therefore, the magnitude of change is considered to be medium.

9.5.58 The medium magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

9.5.59 The retention of a roadside hedgerow within the foreground will partially obstruct views towards the route in the summer months where leaf cover provides a dense visual screen. However, gaps will allow more open views and therefore the magnitude of change is considered to be medium.

9.5.60 By year 15 and beyond to year 60 of operation, the growth and maturity of planting will further screen the Proposed Scheme, meaning effects on this viewpoint will be non-significant. This is reported in Volume 5: Appendix LV-001-024 and shown on Map LV-08-082, E6,(Volume 2, CFA24 Map Book.

Viewpoint 305.2.008: view north-east across open space adjacent to Yorkminster Drive from residences on Foxland Close

9.5.61 Visibility of the Proposed Scheme from this location will be limited to overhead line equipment and glimpses of the upper sections of trains through intervening vegetation. Views from upper floors will be potentially more extensive, although still limited to the upper sections of new infrastructure. The removal of overhead power line transmission towers within Heath Park will represent a beneficial change to the existing view. However, the overall magnitude of change is considered to be medium adverse.

9.5.62 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.

9.5.63 In summer the vegetation in the middle ground will provide a more effective screen. However, glimpses of overhead line equipment and trains above or through gaps in the vegetation will remain and the significance of effect will be unchanged.

9.5.64 By year 15 and beyond to year 60 of operation, the growth and maturity of proposed planting in the foreground will substantially screen the previously visible elements of the Proposed Scheme described above, meaning effects on this viewpoint will be non-significant. This is reported in Volume 5: Appendix LV-001-024 and shown on Map LV-08-082a, E2, Volume 2, CFA24 Map Book.

Viewpoint 306.4.001: view south-west along M6 slip road from Coleshill Heath Road overbridge

9.5.65 The M6 motorway box structure will be visible in close proximity, crossing above the M6 corridor and dominating the foreground. The combination of the height of the box structure, at approximately 13m, and the associated Pool Wood will be seen in the context of the M6 corridor. Overhead line equipment, noise fence barriers and trains on the embankment and crossing the M6 motorway box structure will add to the prominence of the Proposed Scheme which will substantially change the view. Therefore, the magnitude of change is considered to be high.

9.5.66 The high magnitude of change, assessed alongside the low sensitivity of the receptor, will result in a moderate adverse effect.

9.5.67 In summer, roadside vegetation along the M6 will frame and emphasise the view of the Proposed Scheme. Therefore, effects will be unchanged.

9.5.68 By year 15 and beyond to year 60 of operation, the scale of the structures and absence of intervening planting of screening value will result in effects being unchanged (see Map LV-08-082a, F3, Volume 2, CFA24 Map Book).

Cumulative effects

9.5.69 Volume 5: Appendix CT-004-000 identifies 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.

9.5.70 It is considered that there are no cumulative effects due to implementation of the Proposed Scheme and based on committed development as referred to in Section 2.1, significant in combination effects are also unlikely.

Other mitigation measures

9.5.71 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 significant effects residual

9.5.72 In most cases, significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. Therefore, the following residual effects will remain following year 15 of operation:

- adverse effects on the M42 corridor LCA arising from the surface level car park and the people mover; and
- adverse effects on the Solihull rural heartland LCA arising from the Birmingham Interchange Station and associated highway and parking infrastructure and the people mover.

9.5.73 Significant effects on views from residences along Middle Bickenhill Lane arising from visibility of the Birmingham Interchange station, car parking and the people mover and people mover depot will occur. These will reduce by year 60 of operation, following greater maturity of the proposed planting.

9.5.74 Significant effects on people travelling on Coleshill Heath Road will occur from visibility of the Proposed Scheme on the M6 motorway box structure.

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 within Volume 3, Section 11. 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, with further detail provided in relation to:

- premises demolished, with their occupants and employees needing to relocate to allow for construction of the Proposed Scheme;
- effects on amenity (e.g. air quality and construction dust, noise and vibration, construction traffic and visual impacts) of an area which could affect a business's operations. Any resulting effects on employment are reported at a route-wide level (see Volume 3); and
- potential employment opportunities arising from construction in the local area (including in adjacent areas).

Operation

10.1.5 The operation of the Proposed Scheme will have relevance in terms of socio-economics, in relation to the potential employment opportunities created by new business opportunities.

10.1.6 Further information on the socio-economics baseline within the area including a business and labour market profile is provided in Volume 5: Appendix SE-001-000.

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 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 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 available within the area[78].

10.3.2 The Birmingham Interchange and Chelmsley Wood area is located within the Solihull Metropolitan Borough Council (SMBC) and North Warwickshire District Council (NWDC) local authority areas. Based on the distribution of affected resources, the focus of this environmental baseline is on the Solihull Metropolitan Borough area.

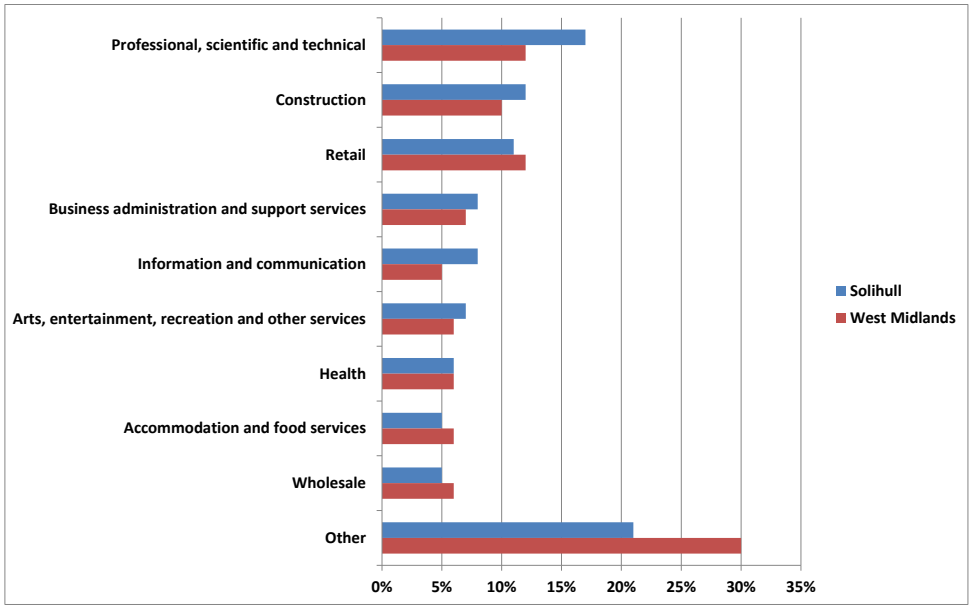
10.3.3 Where possible, baseline data has been gathered on demographic character areas (DCA)[79] to provide a profile of local communities. Map series SE-02 (Volume 5, Map Book Socio-economics) shows the location of the DCAs. The area contains two DCA – Birmingham Interchange and Chelmsley Wood.

Business and labour market

10.3.4 Within Solihull Metropolitan Borough, there is a wide spread of business types reflecting a diverse range of commercial activities. The professional, scientific and technical sector accounts for the largest proportion of businesses (17%), with construction as second largest (12%) followed by retail (11%) and then business administration and support services (8%). This is shown in Figure 12. For comparison within the West Midlands region, professional, scientific and technical and retail jointly accounts for the largest number of businesses (12% each) followed by construction (10%), production (8%) and business administration and support services (7%)[80].

78 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.
79 DCAs 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).
80 Office for National Statistics (2012), UK Business: Activity, Size and Location 2011, ONS, London. Please note 2011 data has been presented to provide an appropriate comparison with 2011 Census data.

Figure 12: Business sector composition in Solihull Metropolitan Borough and the West Midlands[81, 82]

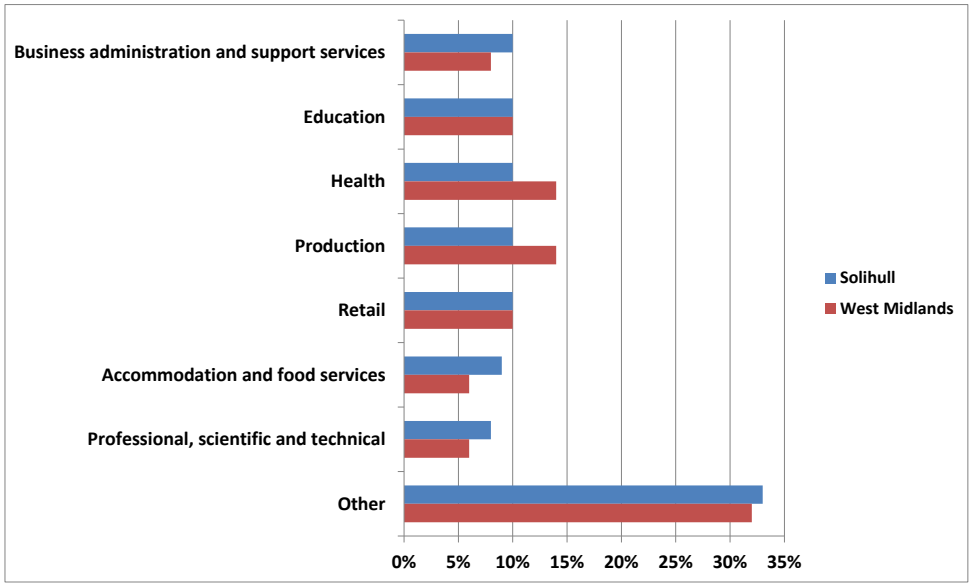


10.3.5 Approximately 97,000 people work in Solihull Metropolitan Borough. Of these, 13,000 worked in Birmingham Interchange DCA and 100 in Chelmsley Wood DCA[83].

10.3.6 According to the Office for National Statistics (ONS) Business Register and Employment Survey 2011, the top five sectors in terms of share of employment in Solihull are health (10%); education (10%); retail (10%); business administration and support services (10%); and production (9%). These compare with the top five sectors for the West Midlands region which are health (14%); production (14%); education (10%); retail (10%); and business administration and support services (8%)[84]. This is shown in Figure 13. In the Birmingham Interchange DCA, transport and storage (29%), followed by accommodation and food services (23%) account for the largest share of employment. In addition, business administration and support services account for 17% of employment. Comparable figures for the West Midlands and England are 5% for transport and storage. For accommodation and food services the West Midlands equivalent is 6% and for England the average is 7%. For Chelmsley Wood DCA, education (48%) followed by health (23%) provides the largest shares of employment with the next highest share of employment taken by construction; arts, entertainment, recreation and other services; and wholesale, all at 8%.

81 "Other" includes: motor trades; transport and storage; finance and insurance; public administration and defence; production; and education sectors.
82 Office for National Statistics (2012) UK Business: Activity, Size and Location 2011, ONS, London.
83 Office for National Statistics (2012), Business Register and Employment Survey 2011, ONS, London.
84 Office for National Statistics (2012), Business Register and Employment Survey 2011, ONS, London.

Figure 13: Employment by industrial sector in Solihull Metropolitan Borough and the West Midlands[85, 86]



10.3.7 According to the 2011 Census[87], the employment rate[88] within Solihull Metropolitan Borough area was 66% (98,000 people), which is higher than that recorded for both the West Midlands (62%) and England (65%). This compares with the employment rate in the Birmingham Interchange DCA, which was 70% (700), and 55% (1,200) in Chelmsley Wood.

10.3.8 In 2011, unemployment in Solihull Metropolitan Borough was 7% which was lower than the West Midlands (9%) and the same as the average for England (7%). The unemployment rate in the Birmingham Interchange DCA was 4%, with 15% recorded for the Chelmsley Wood DCA.

10.3.9 According to the 2011 Census, 29% of Solihull Metropolitan Borough residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 23% in the West Midlands and 27% in England, while 23% of residents had no qualifications which was lower than that recorded for West Midlands (27%) and the same as for England (23%). In 2011, the Birmingham Interchange DCA recorded 22% of residents aged 16 and over as being qualified to NVQ4 and above while 8% of residents in Chelmsley Wood were similarly qualified. The proportion of residents with no qualification was 24% in the Birmingham Interchange DCA and 40% in the Chelmsley Wood DCA[89].

10.3.10 Birmingham Interchange DCA is predominantly an employment centre heavily focused on the transport and accommodation and food services sectors arising from its proximity to Birmingham Airport and the NEC. Chelmsley Wood is a relatively deprived residential area with high unemployment and low qualification rates. The relationship between the two DCAs is illustrative of a socio-economic north – south

85 Other' includes construction, wholesale, information and communication, motor trades, public administration and defence, property, financial and insurance, and agriculture, forestry and fishing sectors.
86 Office for National Statistics (2012), Business Register and Employment Survey 2011, ONS, London.
87 Office for National Statistics (2012), Census 2011, ONS, London.
88 The proportion of working age (16-74 year olds) 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.
89 Office for National Statistics (2012), Census 2011, ONS, London

divide that has developed within Solihull Metropolitan Borough between a relatively deprived "north" represented by Chelmsley Wood DCA and an economically dynamic "south" represented by Birmingham Interchange DCA.

Property

10.3.11 A review of employment land in 2011 identified a need for 3-4 ha per year for general business land in Solihull Metropolitan Borough and that sufficient provision existed until 2021[90].

10.3.12 Average vacancy rate for industrial and warehousing property in Solihull Metropolitan Borough in July 2013 has been assessed as 15% based on marketed space against known stock[91]. Overall, this suggests relatively good availability of alternative accommodation and a good supply of new development land for employment use.

Future baseline

Construction (2017)

10.3.13 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 will result in an approximately additional 2,600[92] jobs 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)

10.3.14 Volume 5: Appendix CT-004-000 provides details of the developments, which are assumed to have been implemented by 2026, though no such developments are located in this study area. As such, there are no consents or allocations in this study area which are expected to accommodate significant additional 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 CoCP 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);

90 Solihull Metropolitan Borough (2012) Employment Land Background Paper, SMBC, Solihull.
91 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).
92 Potential employment has been estimated through employment floor space and the Homes and Communities Agency (HCA) (2010) Employment Densities Guide 2nd Edition. The estimate is calculated using standard employment density ratios and estimates of floor areas.

- 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);
- requiring contractors to monitor and manage flood risk and other extreme weather events which may affect socio-economic 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 Businesses within the area may experience air quality, noise and vibration, visual or construction traffic impacts as a result of construction of the Proposed Scheme. Taken in combination, the residual effects from these other topic assessments may amount to a significant change in amenity, which in turn may lead to a possible loss of trade for the affected businesses. Any resulting effects on employment are reported at a route-wide level (see Volume 3, Section 11.6).

10.4.4 The Hilton Birmingham Metropole hotel is located to the north and east of Pendigo Lake. The construction of the people mover in the vicinity of the hotel will cause significant noise and vibration effects for a period of around nine months. The sensitivity of this hotel is considered to be high as it includes visitor accommodation, restaurant and conferencing facilities which are considered to be susceptible to amenity effects with construction works possibly discouraging use. Given these effects in combination with those of other topics and the high sensitivity, the Proposed Scheme is assessed as having a likely temporary significant amenity effect on this hotel.

10.4.5 The resulting effects on employment are reported in aggregate at a route-wide level (see Volume 3, Section 11.6).

Isolation

10.4.6 No non-agricultural businesses[93] that are expected to experience significant isolation effects as a result of the Proposed Scheme have been identified within the area.

93 Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.

Construction employment

10.4.7 There are plans to locate the Birmingham Interchange station main compound on land off Middle Bickenhill Lane, with a further 17 satellite compounds and two rail installation compounds (one of which, the Birmingham Interchange station satellite compound, will have previously been used for civil engineering construction) to support construction activity. The use of these construction compounds could result in the creation of approximately 3,600 person years or approximately 360 full-time equivalent jobs[94] of construction employment[95] opportunities, which, depending on skill levels required and the skills of local people, are potentially accessible to residents in the locality and to others living further afield. The impact of the direct construction employment creation has been assessed as part of the route-wide assessment (see Volume 3, Section 11.6).

10.4.8 Direct construction employment created by the Proposed Scheme could also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers. The impact of this indirect construction employment creation has been assessed as part of the route-wide assessment (see Volume 3, Section 11.6).

Cumulative effects

10.4.9 No committed developments have been identified that are considered to interact with the Proposed Scheme.

10.4.10 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, Section 11.6).

Permanent effects

Businesses

10.4.11 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 business/ resources are clustered together.

10.4.12 Eight business accommodation units within the area will be directly impacted upon by the Proposed Scheme and these form seven groupings (See Section 2.3 for further details on businesses which will be directly affected). The Olympia Motorcycle Track, business accommodation off the A45 Coventry Road (Top Hat and Tails) and Park Farm constitute two further groupings and are subject to demolition. Land will be taken from within the curtilages of the business properties constituting the remaining four further groupings including Birmingham Business Park; National Motorcycle Museum; Melbicks Garden and Leisure centre and the Toby Carvery public house and

[94] Based on the convention that 10 employment years is equivalent to one full time equivalent job
[95] 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.

restaurant, but no demolition of existing business properties will be required. The effect of land required for the Proposed Scheme will involve the loss of car parking and/ or landscaping and/ or changes to access arrangements. From an employment perspective, no significant direct effects on non-agricultural employment[96] have been identified within the area.

10.4.13 It is estimated that land required for construction of the Proposed Scheme will result in the displacement or possible loss of approximately 30 jobs[97] within this area. Taking into account the availability of alternative premises and the total employed within the district (approximately 97,000), the displacement or possible loss of jobs is considered to be relatively modest compared to the scale of economic activity and opportunity in the area.

Cumulative effects

10.4.14 No committed developments have been identified that are considered to interact with the Proposed Scheme.

10.4.15 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, Section 11.6).

Other mitigation measures

10.4.16 The above assessment has concluded that there are significant adverse effects arising during construction.

10.4.17 Businesses displaced by the Proposed Scheme will be fully compensated within the provisions of the 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.

10.4.18 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 providing support to businesses and local residents to facilitate access to procurement and employment opportunities arising from the construction of the Proposed Scheme.

Summary of likely significant residual effects

10.4.19 The impact of direct and indirect construction employment creation has been assessed as part of the route-wide assessment.

10.4.20 During construction, customers may be discouraged from using the Hilton Birmingham Metropole Hotel over a period of nine months as it is expected to be affected by construction of the people mover route linking the NEC complex to the proposed Birmingham Interchange station.

96 Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.

97 Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floorspace and the Homes and Communities Agency (HCA)(2010) Employment Densities Guide 2nd Edition. The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary from actual employment at the sites.

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 businesses considered likely to experience significant adverse direct effects during the operational phase of the Proposed Scheme within this area.

Change in business amenity

10.5.3 No businesses that are expected to experience significant adverse amenity effects as a result of the Proposed Scheme have been identified within the area.

Operational employment

10.5.4 Current plans are that 100 HS2 related jobs will be created at the Birmingham Interchange station. This excludes associated retail and other opportunities associated with the new station and its linkage to the NEC/ Birmingham Airport via the People Mover investment. The station is likely to encourage further investment in the surrounding area. Some of these employment opportunities will be accessible to residents in the locality. In addition, further jobs are to be expected as a result of operating and maintaining the people mover.

10.5.5 The proposed Birmingham Interchange station is identified as being part of the concentration of economic assets and growth drivers of national and regional significance including Birmingham Airport, the National Exhibition Centre (NEC), Jaguar Land Rover (Automotive) PLC, Solihull Town Centre and Blythe Valley regional investment sites. Known as UK Centre (formerly known as the M42 Economic Gateway[98]), this area is considered to have the potential to generate 63,000 jobs.

10.5.6 Direct operational employment created by the Proposed Scheme could also lead to indirect employment opportunities at local businesses involved in supplying the project or benefiting from expenditure of directly employed workers on goods and services.

10.5.7 Some of these employment opportunities will be accessible to residents in the locality and, given the transport accessibility of the area within the Birmingham travel to work area, residents living further afield.

10.5.8 The impact of operational employment creation has been assessed as part of the route-wide assessment (see Volume 3, Section 11.7).

Cumulative effects

10.5.9 No committed developments have been identified that are considered to interact with the Proposed Scheme.

98 The M42 Economic Gateway refers to the area defined in the M42 Economic Gateway Master Plan published in June 2013 by Solihull Metropolitan Borough Council

Other mitigation measures

10.5.10 The assessment has concluded that operational effects within the area will be beneficial and therefore mitigation is not required.

Summary of likely significant residual effects

10.5.11 The impact of operational employment creation has been assessed as part of the route-wide assessment.

10.5.12 There are no other significant adverse effects identified in this 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 Birmingham Interchange and Chelmsley Wood 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[99]; 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'[100].

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 assessment for Birmingham Interchange and Chelmsley Wood is available in the relevant appendices in Volume 5:

[99] '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.

[100] Quiet areas are defined in the Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations 2006 or are resources which are prized for providing tranquillity (further information is provided in Section 9) .

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000);
- sound, noise and vibration baseline (Appendix SV-002-024);
- sound, noise and vibration construction assessment (Appendix SV-003-024);
- sound, noise and vibration operation assessment (Appendix SV-004-024); and
- Maps SV-01 to SV-04, Volume 5, Map Book Sound, noise and vibration.

11.2 Environmental baseline

Existing baseline

11.2.1 The sound environment in the area of Birmingham Interchange and Chelmsley Wood reflects the mix of usage and activity in the area ranging from the large residential community of Chelmsley Wood in the north of the area, the commercial area of Birmingham Business Park and the extensive estate of the National Exhibition Centre (NEC) with its associated hotels and car parks.

11.2.2 The south and east of the area is more rural with a few small communities and some relatively isolated residences and farms. The significant roads that cross the area are: the M42; the M6; the A45 Coventry Road; the A452 Chester Road and the A446 Stonebridge Road. Daytime sound levels at properties close to the M6 and A452 Chester Road are typically around 65 to 70 dB[101].

11.2.3 Other main transport sound sources are the Rugby to Birmingham line and Birmingham Airport. Most large communities in the area lie parallel to the main runway and are therefore not generally over-flown by the main air traffic. Some receptors in the south of the area are close to the flight path, but aircraft are generally not the dominant sound source in this area.

11.2.4 Away from these major transport sources the sound environment comprises local road traffic, agricultural activities and, in quieter areas, natural sounds.

11.2.5 To the south of the area, existing baseline sound levels are dominated by road traffic on the A45 Coventry Road, M42 and to some extent the A452 Chester Road. In areas away from these roads, daytime sound levels are typically around 55 to 60dB, with the traffic on these major roads still the dominant source of sound. Night-time sound levels[102] are generally slightly lower than those during the daytime, although in many locations this reduction is small in magnitude (up to around 5dB lower).

11.2.6 Through Birmingham Business Park, where the existing sound environment is dominated by traffic on the A452 Chester Road, typical daytime sound levels are around 55dB. Natural sounds become more notable as the sound levels reduce at greater distances from this road.

[101] Quoted dB values at residential areas refer to the free-field 16 hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, $L_{pAeq,16hr}$.
[102] Night-time sound levels refer to the free-field 8 hour night-time (23:00 to 07:00) equivalent continuous sound pressure level, $L_{pAeq,8hr}$.

11.2.7 Within Chelmsley Wood, existing daytime sound levels are dominated by traffic on the A452 Chester Road and the M6 and are typically 65dB at the locations closest to these roads. At greater distances from these roads, where intervening houses provide significant screening, typical daytime sound levels are around 50dB and the sound environment includes traffic on local roads and natural sounds. Close to the major roads, night-time sound levels are only slightly lower than those during the daytime (up to around 5dB lower), though at greater distances from the roads, this difference is larger (typically 10dB).

11.2.8 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in Volume 5: Appendix SV-002-024.

11.2.9 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration[103]. 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

11.2.10 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[104], tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

11.2.11 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)

11.2.12 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 with the proposed start of passenger services. The future baseline is for the sound environment that would exist in 2026 without the Proposed Scheme.

[103] Further information is available in Volume 5: Appendix SV-001-000 (SMR) and SV-001-000/2(SMR Addendum).
[104] Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph

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/or night-time for reasons of safety, engineering practicability or to reduce the impact on existing transport:

- various bridge deck and/or road tie-in works on the A45 Coventry Road, East Way, M42 junction 6, A452 Chester Road, A452 southbound on and northbound off links, A452 Link Road, A446 southbound off and northbound on links , A452 Station Entry link road and M6 junction 4;
- sections of the people mover viaduct deck to the NEC and Birmingham Airport;
- M42 motorway viaduct beams; and
- installation and removal of railway protection barriers in the vicinity of Birmingham International station during people mover works.

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. Further information on criteria is provided in Volume 5 Appendix SV-001-000.

Local limitations

11.3.4 In this area, there is a location 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 support the assessment. Further information is provided in Volume 5: Appendix SV-002-024.

Avoidance and mitigation measures

11.3.5 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[105]; 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 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.

11.3.6 In addition to this mitigation, screening as described in the draft CoCP[106] has been assumed along edge of the construction site boundary adjacent to the residential properties on Middle Bickenhill Lane and the residential and commercial premises at Park Farm and Common Farm.

11.3.7 Noise insulation will be offered for qualifying buildings as defined in the draft CoCP's noise insulation and temporary re-housing policy. Noise insulation or ultimately temporary re-housing will avoid residents being significantly affected[107] by levels of construction noise inside their dwellings. The assessment reported in this section provides an estimate of the buildings that are likely to qualify for such measures.

11.3.8 Qualification for noise insulation and temporary re-housing will be identified as part of seeking prior consent from the local authorities under Section 61 of CoPA. Qualifying buildings will be identified early enough so that noise insulation can be installed, or temporary re-housing provided, before the start of the works predicted to exceed noise insulation or temporary re-housing criteria. Noise insulation, where required, will be installed as early as possible to reduce internal sound levels from construction activities and also when the Proposed Scheme comes into operation.

[105] Warning signals that consist of bursts of noise
[106] 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
[107] Information is provided in the emerging National Planning Practice Guidance – Noise http://planningguidance.planningportal.gov.uk, e.g. the table summarising the noise exposure hierarchy

11.4 Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.4.1 Taking account of the avoidance and mitigation measures set out in the previous paragraphs, two residential buildings: Park Farm; and the dwelling at the northern end of Old Station Road, Hampton-in-Arden closest to the M42 junction 6 works, are forecast to experience noise levels higher than the noise insulation trigger levels as defined in the draft CoCP. For daytime construction the trigger level is 75dB[108] measured outdoors, or the existing ambient if this is already above this level. The equivalent night-time trigger level is 55dB, or the existing ambient if this is already above this level[109].

11.4.2 The mitigation measures, including noise insulation, will reduce noise inside all dwellings, including those at Park Farm and Old Station Road, such that it does not reach a level where it would significantly affect residents.

Residential receptors: direct effects – communities

11.4.3 The avoidance and mitigation measures in this area will avoid airborne construction noise adverse effects on the majority of receptors and communities. Residual temporary noise or vibration effects are identified later in this section.

11.4.4 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

11.4.5 In locations with lower existing sound levels[110], construction noise adverse effects are likely to be caused by changes to noise levels outside dwellings. These may be considered by the local community as an effect on the acoustic character of the area and hence be perceived as a change in the quality of life. These effects are considered to be significant when assessed on a community basis taking account of the local context[111].

11.4.6 Vibro-compaction is likely to result in appreciable ground-borne vibration at a small number of individual dwellings, situated closest to this activity[112], resulting in moderate adverse effects[113] at these properties. These receptors will also be exposed to appreciable noise from the construction of the Proposed Scheme. The significance of the identified vibration effects has been assessed in combination with the airborne noise also identified at these receptors. Further information is included in Volume 5: Appendix SV-003-024.

11.4.7 In this area, the mitigation measures reduce the adverse effects of construction airborne noise and ground-borne vibration on the local residential communities such that the adverse effects identified are considered to be not significant.

[108] $L_{pAeq,0800\text{-}1800}$ measured at the facade, outdoors, or the existing ambient if this is already above this level
[109] $L_{pAeq,2200\text{-}0700}$ measured at the façade, outdoors, or the existing ambient if this is already above this level
[110] Further information is provided in Volume 5: Appendix SV-001-000.
[111] Further information is provided in Volume 5: Appendix SV-001-000 and SV-003-024.
[112] Further information is provided in Volume 5: Appendix SV-003-024.
[113] There is no risk of damage, even cosmetic, to buildings.

Residential receptors: indirect effects

11.4.8 Significant noise effects on residential receptors arising from construction traffic are unlikely to occur in this area.

Non-residential receptors: direct effects

11.4.9 On a worst case basis, significant construction noise or vibration effects have been identified on the following non-residential receptors:

- the closest NEC buildings to the people mover, Exhibition hall 1 and the Pavilion area (CSV24-N01). Significant noise effects[114] have been identified during the daytime from construction noise levels rising at times to 76dB[115]. The duration of impact could be up to 35 months commencing in 2019. The significance and duration of the effect will depend on the exact usage of the affected areas and the sound insulation of the buildings;
- Crowne Plaza Birmingham NEC and Hilton Birmingham Metropole hotels (CSV24-N02). Significant noise effects have been identified during the daytime from construction noise levels rising at times up to 71dB. The durations of the effect on each hotel are approximately 36 and 46 months respectively commencing in 2019 and 2017 respectively. Vibratory piling works also result in a minor adverse effect at the Hilton Birmingham Metropole hotel, when at their closest;
- Novotel, Ibis and Etap hotels at Birmingham Airport (CSV24-N03). Significant noise effects have been identified during the daytime from construction noise levels rising at times to 64dB.The duration of impact is approximately 15 months commencing in 2020; and
- Diamond House office building at Birmingham Airport (CSV24-N04). Significant noise effects have been identified during the daytime from construction noise levels rising at times to 77dB.The duration of impact is approximately one month in 2020.

11.4.10 Further information is provided in Volume 5 Appendix SV-003-024.

Non-residential receptors: indirect effects

11.4.11 Significant noise effects on non-residential receptors arising from construction traffic are unlikely to occur in this area.

Cumulative effects from the Proposed Scheme and other committed development

11.4.12 This assessment has considered the potential cumulative construction noise effects of the proposed scheme and other committed developments[116]. 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.

[114] Potential activity disturbance, especially for activities that require good conditions for verbal communication
[115] Equivalent continuous sound level at the facade, $L_{pAeq,\ 0700\text{-}1900}$.
[116] Refer to Volume 5: Appendix CT-004-000.

Summary of likely significant residual effects

11.4.13 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 residents.

11.4.14 The measures also reduce the adverse effect of outdoor construction noise and ground-borne vibration on local residential communities such that the effects are not considered to be significant.

11.4.15 On a worst case basis, noise and/or vibration from specific construction activities has been identified as resulting in significant residual temporary effects on: a range of buildings at the NEC including Hall 1 and the Pavilion area; the Crowne Plaza Birmingham NEC, Hilton Birmingham Metropole, Novotel, Ibis and Etap hotels; and the Diamond House office building.

11.4.16 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.

11.5 Effects arising during operation

Local assumptions and limitations

Local assumptions – service pattern

11.5.1 The effects of noise and vibration from the operation of the Proposed Scheme have been assessed based on the highest likely train flows, including the 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[117]. As a reasonable worst case, this assessment is based upon the service pattern for Monday to Saturday including Phase Two services. 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 15. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after 21:00 and the last service will arrive at terminal stations by 24:00. Train speeds are shown in Table 15.

Table 15: 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
Main line	0700 - 2100 hours	18 (14)	330 kph for 90% of non-stopping services and

[117] The change in noise and vibration effects between the different passenger services is assessed in Volume 1

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
between London and the north			360 kph for 10% of non-stopping services. Trains stopping at Birmingham Interchange will reduce in speed from the main (non-stopping) lines to the station platforms.
Between Interchange and Delta Junction		3 (3)	Up to 230 kph
Between Interchange and North Chord Connection		16 (8)	330 kph for 90% of non-stopping services and 360 kph for 10% of non-stopping services. Trains stopping at Birmingham Interchange will reduce in speed from the main (non-stopping) lines to the station platforms.

Avoidance and mitigation measures

11.5.3 The development of the Proposed Scheme has, as far as reasonably practicable, kept the alignment away from main communities and low in the ground. These avoidance measures have protected many communities from likely significant noise or vibration effects.

Airborne noise

11.5.4 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 3 dB 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.

11.5.5 To avoid or reduce significant airborne noise effects, the Proposed Scheme incorporates noise barriers in the form of landscape earthworks and noise fence barriers. Noise barrier locations are shown on Map SV-05, Volume 2, CFA24 Map Book.

11.5.6 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.

11.5.7 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.

11.5.8 Noise effects are reduced in other locations along the line, for example Landscape Character Areas, 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 Map SV-05, Volume 5, Map Book Sound, noise and vibration.

11.5.9 Significant noise effects from the operational static sources such as line-side equipment, the people mover and those at Interchange Station will be avoided through their design and the specification of noise emission requirements (for further information please see Volume 5: Appendix SV-001-000).

11.5.10 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996[118] (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.

11.5.11 Where required, as well as improvements to the noise insulation of windows facing the railway , ventilation will be provided so that windows can be kept closed to protect internal sound levels.

11.5.12 Following Government's emerging National Planning Practice Guidance[119], 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[120], 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[121]. 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[122], or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion[121], noise insulation will be offered for these additional buildings.

Ground-borne noise and vibration

11.5.13 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

[118] Her Majesty's Stationery Office (1996), The Noise Insulation (Railways and Other Guided Transport Systems) Regulations, London.
[119] National Planning Practice Guidance – Noise http://planningguidance.planningportal.gov.uk; Accessed June 2013
[120] World Health Organization, Night-time Noise Guidelines for Europe, 2010
[121] 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: 85 dB L_{pAFmax} (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80 dB LpAFmax (where the number of train pass-bys exceeding this value is greater than 20).
[122] Equivalent continuous level, $L_{pAeq,23:00-07:00}$ measured without reflection from the front of buildings

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

Surface sections of route; airborne noise and ground-borne vibration

11.5.14 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified one residential building close to the Proposed Scheme – Common Farm on the A452 Chester Road, Coleshill – 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. The building is indicated on Map SV-05, Volume 5, Map Book Sound, noise and vibration.

11.5.15 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

11.5.16 The avoidance and mitigation measures in this area will avoid significant airborne noise effects on the majority of receptors, and at the following communities:

- Coleshill; and
- Chelmsley Wood.

11.5.17 Taking account of the envisaged mitigation, Map SV-05, Volume 2 CFA24 Map Book shows the long-term 40dB[123] 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[124]. In general, below these levels adverse effects are not expected.

11.5.18 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 effects forecast for the operation of the scheme are presented on Map SV-05, Volume 2, CFA24 Map Book).

11.5.19 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[125].

11.5.20 However as a result of the avoidance and mitigation measures included within the Proposed Scheme, the assessment has not identified any adverse effects that are considered to be significant on a community basis.

[123] Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$)
[124] 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.
[125] Further information is provided in SV-001-000 and SV-004-024.

Residential receptors: indirect effects

11.5.21 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

11.5.22 The assessment of operational noise and vibration indicates that significant effects are likely on the non-residential receptors identified in Table 16.

11.5.23 The assessment of effects on non-residential receptors has been undertaken on a reasonable worst case basis taking account of public available information about each receptor. Further information can be found in Volume 5: Appendix SV-004-024.

Table 16: Likely significant noise or vibration effects on non-residential receptors arising from operation of the Proposed Scheme

Significant effect number (see Map series SV-05)	**Type of significant effect and source**	**Time of day**	**Location and details**[31]
OSV24-N01	Potential noise disturbance of office activities[126] inside two office buildings due to the operation of train services.	Daytime	Two office buildings at Birmingham Business Park located closest to the route
OSV24-N02	Potential disturbance of hotel activities[32] due to the operation of train services	Daytime and night-time	Holiday Inn Express Birmingham NEC

Non-residential receptors: indirect effects

11.5.24 The assessment of operational noise and vibration indicates that significant indirect effects are unlikely to occur on non-residential receptors in this area.

Summary of likely significant residual effects

11.5.25 The mitigation measures reduce noise inside all dwellings such that it does not reach a level where it would significantly affect residents.

11.5.26 The avoidance and mitigation measures in this area will avoid noise and vibration adverse effects on the majority of receptors and communities including shared open areas. Taking account of local context the adverse effects identified are not considered significant on a community basis.

11.5.27 On a reasonable worst case basis a significant noise effect has been identified on two offices at Birmingham Business Park that are located closest to the route and the Holiday Inn Express Birmingham NEC.

11.5.28 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.

[126] Potential for activity disturbance, especially for activities that require good conditions for verbal communication

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 Birmingham Interchange and Chelmsley Wood area (CFA24).

12.1.2 With regard to traffic and transport, the main issues are increased traffic as a result of the construction and the operation of the Proposed Scheme, road diversions, temporary and permanent road closures, and temporary and permanent diversions of footpaths. The Proposed Scheme will also bring major transport benefits including increased rail capacity, reduced rail journey times, released capacity on the WCML and associated reductions in crowding and opportunities to operate additional services, and improved connectivity to major destinations in this area.

12.1.3 The effects on traffic and transport are 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 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 Solihull Metropolitan Borough Council (SMBC), Birmingham City Council (BCC), Coventry City Council (CCC), Warwickshire County Council (WCC), Centro (the West Midlands Integrated Transport Authority), the Highways Agency (HA) and Network Rail.

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 includes the M42 junction 6, M6 junction 4, A45 Coventry Road from west of Damson Parkway to east of Stonebridge Island, A452 Chester Road, A446 Stonebridge Road, Coleshill Heath Road, Birmingham Airport approach roads and National Exhibition Centre (NEC) approach and circulation routes.

12.2.3 A number of transport modelling tools have been used to inform the assessment including the West Midlands authorities' regional transport model, PRISM (Policy Responsive Integrated Strategy Model), for future 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 West Midlands have been determined through site visits, specially commissioned traffic and transport surveys and liaison with West Midlands Transport Authorities and stakeholders to source transport models, information on public transport, public rights of way (PRoW) and accident data.

12.3.2 Traffic surveys of all roads crossing the route or potentially affected were undertaken in June 2012 and June 2013 comprising junction turning counts and queue surveys, automatic traffic counts, and journey time surveys. Traffic and transport surveys were also undertaken at Birmingham International station. This was supplemented by traffic and transport data obtained from other sources where available, including from the HA, SMBC, Centro and the regional transport model. The highway peak hours in the study area were 08:00-09:00 and 17:00-18:00.

12.3.3 Surveys of pedestrian and cyclist movements were undertaken in August and September 2012 and May and June 2013 to establish the nature of the PRoW and their usage by non-motorised users (pedestrians, cyclists and equestrians). The surveys included all PRoW and roads that will cross the route of the Proposed Scheme, and any additional PRoW and roads that will be affected by the Proposed Scheme. Two PRoW were used by less than 10 people a day. There were also five roadside footways or footpaths that were used by less than 10 people per day. The routes with the greatest usage were Solihull Parkway with 101 users per day and Yorkminster Drive with 87 users per day.

12.3.4 There are several strategic routes that pass through the area. The M42 travels in a north/south direction and is accessed in the area from junction 6. The M6 runs from the north-west to south-east, intersecting with the M42 at junction 7, and is accessible from junction 4 in this area. The A45 Coventry Road passes through the southern area in an east/west direction connecting with the M42 at junction 6 and A452 Chester Road at Stonebridge Island. The A45 Coventry Road provides access to the NEC, Birmingham Airport and Birmingham International station. The A452 Chester Road runs in a north-west/south-east orientation providing access to Chelmsley Wood, the NEC and Birmingham Business Park. The A446 Stonebridge Road has a north/south orientation linking the M6 junction 4 and A452 Chester Road, at the A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout. The strategic roads within the area are busy at peak times and delays can be experienced on the M42, M42 junction 6, M6, M6 junction 4, Stonebridge Island, and the A45 Coventry Road/Damson Parkway junction in particular.

12.3.5 The main local roads affected by the Proposed Scheme are Coleshill Heath Road, which leads to Coleshill, Solihull Parkway, which leads to the Birmingham Business Park, Bickenhill Parkway which leads to the NEC and Birmingham Airport, Middle Bickenhill Lane, which provides local access to residential properties, Northway, Southway and East Way, which provide access to and movement around the NEC, and the A45 Service Road, which provides access to the Bickenhill Waste Recycling Centre and other industrial premises. The local road network generally operates more efficiently than the strategic roads, but it can also be busy at peak times.

12.3.6 Relevant accident data for the road network subject to assessment has been obtained from SMBC, BCC and WCC for the three-year period of 2009 to 2011. This has been assessed and any identified clusters have been examined. No significant accident clusters were identified in the area.

12.3.7 There are nine public bus services that serve the Birmingham International station, the NEC and Birmingham Airport area. The bus services provide connections to destinations including Coventry, Birmingham, Solihull, Chelmsley Wood, Marston Green, Erdington, Birmingham Business Park and Blythe Valley Business Park. These services provide a maximum combined service frequency of approximately 27 buses per hour between Monday and Friday.

12.3.8 The southern area of Chelmsley Wood is served by nine public bus services. These bus services provide connections to destinations including Birmingham, Solihull, Marston Green, Erdington and Birmingham Airport. These services provide a maximum combined service frequency of approximately 56 buses per hour between Monday and Friday.

12.3.9 National and local rail services are accessible via Birmingham International station. Marston Green station is located on the north-west boundary of the area providing access to local services between Coventry and Birmingham.

12.3.10 The Proposed Scheme crosses one PRoW (FP M104), which passes under the proposed people mover and affects four others (FP M96, FP M105, FP M107 and FP M114). In addition, FP M77 (Green Lane) lies partially within this area but crosses under the scheme in the adjoining area and is assessed in the Coleshill Junction (CFA19).

12.3.11 There are pedestrian footways in the built up area of Chelmsley Wood and in the area around Birmingham Airport, the NEC, Birmingham International station and Birmingham Business Park. In the rural area around the proposed Birmingham Interchange station, there are occasional sections of footways. In the area around the proposed Birmingham Interchange station, and in Chelmsley Wood, there are several advisory cycle routes, along with a route through the NEC to Birmingham International station.

12.3.12 There are no navigable waterways affected by the Proposed Scheme in this area and consequently these are not considered further in this assessment.

Future baseline

12.3.13 Future baseline traffic volumes for the years of assessment 2021, 2026 and 2041, have been calculated by applying growth factors based on PRISM, thus taking account of any planned developments.

12.3.14 The Birmingham Airport Runway Extension (including the realignment of the A45 Coventry Road), AEC facility at Birmingham Business Park and Resorts World at the NEC are major committed developments within the area, which have been allowed for in the future baseline traffic volumes. Other planned developments are included as part of the traffic growth derived from PRISM. Planned infrastructure improvements at the M42 junction 6 are also included in the future baseline scenarios.

Construction

12.3.15 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 16% by 2021 compared to 2012.

Operation (2026)

12.3.16 Future baseline traffic volumes in the peak hours are forecast to grow by around 25% by 2026 compared to 2012.

Operation (2041)

12.3.17 Future baseline traffic volumes in the peak hours are forecast to grow by around 43% by 2041 compared to 2012.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The following measures (as described in Section 2) have been included as part of the engineering design of the Proposed Scheme and will avoid or reduce effects on transport users:

- creation of a haul road running north/south from the neighbouring Balsall Common and Hampton-in-Arden area (CFA23) to just south of the existing A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout;
- 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 minimal diversions of traffic onto alternative routes;
- restricting road closures to overnights and weekends where reasonably practicable;
- construction of a new alignment on the A452 Chester Road, and the replacement for the A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout before closure of the existing roads;
- Heavy Goods Vehicles (HGV) routeing, as far as reasonably practicable, along the strategic road network, and using designated routes for access, as shown on Maps TR-03-154 to TR-03-155a, Volume 5, Map Book, Traffic and transport);
- temporary diversion provided for five PRoW and one footpath;
- provision of worker accommodation at the Birmingham Interchange for workers not normally based locally; and
- provision of on-site welfare facilities to reduce daily travel by site workers.

12.4.2 The draft CoCP (see Volume 5: Appendix CT-003-000) includes measures which 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 the 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[127] 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. This will encourage the use of sustainable modes of transport.

12.4.4 The measures in the draft CoCP include clear controls on vehicle types, hours of site operation, and routes for HGVs to reduce the impact of road based construction traffic. In order to achieve this, generic and site specific traffic management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads, bridleways, 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 to 18:00 on weekdays and 08:00 to 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 (draft CoCP, Section 5); and
- excavated material will be reused wherever reasonably practicable along the route of the Proposed Scheme which will reduce the effects of construction vehicles on the public highway (draft CoCP, Section 15).

12.4.6 Where works potentially affect Network Rail assets, disruption to travelling passengers and freight movements will be minimised as far as possible. This includes measures such as:

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

[127] 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.

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 area will include:

- construction vehicle movements to and from the various worksites, including to and from adjacent CFAs;
- road closures and associated diversions;
- displacement of parking and loading; and
- footway and footpath realignments.

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. The duration of when there will be busy transport activity at each compound is shown in Table 17. This represents the periods when the construction traffic flows will be greater than 50% of the peak month flows. The estimated number of daily vehicle trips during the operation of each compound is shown, the lower end of the range shows the average number of trips in the busy period and the upper end 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 17: Typical vehicle trip generation for construction site compounds in this area

Compound Type	Location	Access	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and during peak month of activity	
						Cars/ LGV	HGV
Satellite compound	A45 (Stonebridge Island) satellite compound	A45 Coventry Road westbound off-slip approach to Stonebridge Island	Q2 2017	1	9	10-15	15-15
Satellite compound	A45/A45 Service Road overbridges satellite compound	A45 Coventry Road westbound service road, between Stonebridge Island and Bickenhill Waste Reception Centre entrance	Q2 2017	4.5	3	15-20	220-220

Compound Type	Location	Access	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and during peak month of activity	
						Cars/ LGV	HGV
Satellite compound	East Way underbridge Loop satellite compound	A45 Coventry Road westbound service road, between Bickenhill Waste Recycling Centre and East Way Loop	Q2 2017	4.5	2	10-15	30-30
Satellite compound	A45/East Way overbridges satellite compound	A45 Coventry Road eastbound service road, between East Way Loop and Stonebridge Island	Q2 2017	4.5	4	10-15	30-30
Satellite compound	A45/M42 junction 6 roundabout satellite compound	Off northbound M42	Q2 2017	1.5	9	30-45	15-20
Satellite compound	Birmingham Interchange car park (east) satellite compound	A45 Coventry Road eastbound service road, opposite East Way Loop	Q2 2017	2.5	8	45-65	30-30
Satellite compound	People mover Pendigo Lake satellite compound	Southway between Pendigo Way and M42 junction 6	Q4 2019	3	2	25-35	<10-<10
Satellite compound	People mover M42 crossing satellite compound	East Way between Pendigo Way and M42 southbound slip road loop	Q4 2019	3	2	25-35	<10-<10
Satellite compound	Birmingham Interchange car park (west) satellite compound and people mover depot compound	A45 Coventry Road eastbound service road, opposite East Way Loop	Q4 2019	3	2	25-35	<10-<10
Main compound	Birmingham Interchange station main	A45 Coventry Road eastbound service road, between East	Q2 2017	5.5	15	140-190	20-30

Compound Type	Location	Access	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and during peak month of activity	
						Cars/ LGV	HGV
	compound	Way Loop and Stonebridge Island					
Satellite compound	People mover Birmingham International station satellite compound	Bickenhill Lane, off at roundabout with Station Link Road via car park entrance	Q4 2019	3	3	30-45	<10-<10
Satellite compound	People mover NEC station satellite compound	Perimeter Road	Q4 2019	3	1	30-45	<10-<10
Satellite compound	People mover Birmingham Airport station satellite compound	Hermes Road	Q4 2019	3	1	25-35	<10-<10
Satellite compound	A452/A446 roundabout satellite compound	A452 Chester Road northbound, north of diverge from A446 Stonebridge Road	Q1 2017	2	13	25-35	200-220
Satellite compound	M42 motorway viaduct (east) satellite compound	A452 Chester Road northbound, between Melbicks Garden and Leisure centre entrance and A452/ A446 roundabout	Q3 2017	4.5	5	15-25	175-190
Satellite compound	M42 motorway viaduct (west) satellite compound	B4438 Bickenhill Parkway between A452 Chester Road / A446 Stonebridge Road roundabout and Northway roundabout	Q3 2017	4.5	12	10-15	25-30
Satellite compound	M6 junction 4 satellite	Access off M6 junction 4	Q3 2017	2.5	2	30-40	30-30

Compound Type	Location	Access	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and during peak month of activity	
						Cars/ LGV	HGV
	compound	roundabout					
Satellite compound	Coleshill Heath Road underbridge satellite compound	Yorkminster Drive	Q1 2021	2.5	10	15-25	30-35

12.4.11 Information on the indicative construction programme and methodology is provided in Section 2.3. Works will include construction of the station including access roads and car parking, the people mover, utilities diversions, earthworks, bridge and highway works including capacity improvements. The peaks in activity at individual compounds, based on the scope, scale and programme of works are not expected to occur simultaneously at compounds as the peak of activity for individual compounds rarely overlaps.

12.4.12 The construction compounds will also be the main location for advance works including utilities. It should be noted that the activity associated with the advance works (including utilities) and rail installation works, which will follow on after the civils work, will be of a lower intensity and will generate a lower level of HGV activity.

12.4.13 The construction assessment considers the traffic and transport impacts and effects in three peak months of construction activity, based on the proposed phasing of the works. The peak months have been identified as Months 22 (2018 Quarter 4), 27 (2019 Quarter 1) and 36 (2019 Quarter 4), which are each assessed. In Months 22 and 27 there will be 10 operational worksites, and in Month 36 there will be 12 worksites that would be in operation. The construction assessment considers average construction traffic levels for the peak months and outside of these peaks activity is expected to be lower for much of the time. In considering the effects of the Proposed Scheme, where these occur in particular months assessed this is identified. In general the effects are greatest in Month 27. The assessment of these three peaks in activity has been used to ensure that all significant effects are identified. Where impacts and effects occur in particular peak periods these are identified below. Where impacts relate to specific activities these are identified.

12.4.14 The construction assessments have also considered any impacts that arise from construction in the adjoining areas.

12.4.15 Month 27 represents the overall peak month of activity, and in this month there are estimated to be approximately 4,750 vehicle movements (in/out) per day across the study area. This includes construction vehicle movements which pass through this area to access five adjacent CFAs. The largest of these movements will be to the

Balsall Common and Hampton-in-Arden area (CFA23), where there will be approximately 1,400 vehicle trips routed via the strategic road network to Stonebridge Island and the A452 Kenilworth Road, to reduce impacts on villages. Approximately 850 vehicle movements are to the Coleshill Junction area (CFA19), which pass through on the M6 or M42 via the A45 Coventry Road, A452 Chester Road and A446 Stonebridge Road. Traffic to the Birmingham CFAs largely passes through this area on the motorways. The split of construction vehicles is expected to be 47% HGVs and 53% cars and light goods vehicles (LGV).

12.4.16 It is proposed that the M42, M6, A45 Coventry Road, A452 Chester Road and A446 Stonebridge Road will provide the primary HGV access routes.

12.4.17 There will be temporary closures of a number of roads within the area, including the following:

- weekend and overnight closures of the M42 between junctions 6 and 7, M42 junction 6 and M6 junction 4;
- weekend and overnight closures of the A45 Coventry Road, A452 Chester Road, A446 Stonebridge Road and the A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout;
- weekend and overnight closures of the B4438 Bickenhill Parkway; and
- weekend and overnight closures of roads around Birmingham Airport, Birmingham International station and the NEC, including Airport Way/ Hermes Road roundabout, the Station Link Road, East Way, Pendigo Way, East Car Park Road and the Perimeter Road.

12.4.18 Weekend and overnight closures are not expected to have a significant effect on traffic flows and delays to vehicle occupants as a result of diversions.

12.4.19 In addition to the weekend and overnight closures, the construction of the Proposed Scheme will require temporary traffic management measures including lane restrictions on the M42, M42 junction 6, M6 junction 4 and the M42 between junctions 6 and 7. There will also be lane restrictions required on the strategic routes around Birmingham Interchange including the A45 Coventry Road, A452 Chester Road, A446 Stonebridge Road, as well as the local roads. The lane restrictions will be scheduled to minimise the impacts on traffic in the peak periods with advance notice provided to travellers.

12.4.20 The proposed road works and associated temporary traffic management measures will be likely to result in reduced capacity and some delays on the M42, M42 junction 6, M6, M6 junction 4, the A45 Coventry Road, A452 Chester Road, A446 Stonebridge Road and A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout. These are expected to have a moderate adverse effect although the temporary traffic management measures would be agreed with the HA, SMBC, and WCC in advance, and would be likely to substantially mitigate this effect.

12.4.21 The northern section of Middle Bickenhill Lane will be permanently closed to general traffic to facilitate the construction and operation of the Proposed Scheme. The southern section will be retained to provide access to the existing residential

properties. The permanent closure of Middle Bickenhill Lane will result in the re-routing of around 25 vehicles in the morning and evening peak hours. The Middle Bickenhill Lane closure will have no material impact on the overall traffic flows.

12.4.22 During weekend and overnight closures the main increases in traffic flows will occur on roads used as temporary diversion routes, but this will not have a significant effect on congestion and delays because the underlying baseline traffic flows at these times are lower than the daytime flows on a weekday.

12.4.23 Changes in peak hour traffic flows as a result of construction traffic, will lead to a significant effect on congestion[128] and delays on the road links shown in Table 18.

Table 18: Significant effects on congestion and delays in this area

Road Link	**Effect on congestion and delay**		
	Month 22	**Month 27**	**Month 36**
M42, between junction 5 and the M6 on-slip roads	N/A*	Minor adverse	N/A*
M42 junction 6 southbound on-slip	N/A*	Minor adverse	N/A*
A45 Coventry Road, between M42 junction 6 and Oak Lane	N/A*	Minor adverse	N/A*
A45 Coventry Road, westbound on-slip at Stonebridge Island	Minor adverse	Minor adverse	Minor adverse
A45 Coventry Road, eastbound off-slip at Stonebridge Island	Minor adverse	N/A*	Minor adverse
A45 Coventry Road, westbound off-slip at M42 junction 6	Minor adverse	Major adverse	Minor adverse
A446 Stonebridge Road, between M6 junction 4 and Stonebridge Island	N/A*	Minor adverse	N/A*
A452 Chester Road, between Packington Lane and Stonebridge Island	N/A*	Minor adverse	N/A*

● N/A: no significant effect.

[128] In assessing significant effects of traffic changes on congestion and delays, a major adverse effect occurs where traffic flows 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 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 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.

12.4.24 Table 19 presents the significant effects on severance[129] for non-motorised users as a result of changes in traffic flows.

Table 19: Significant effects on traffic severance for non-motorised users in this area

Road Link	**Effect on severance for non-motorised users**		
	Month 22	**Month 27**	**Month 36**
M42 junction 6 southbound on-slip	Minor adverse	Minor adverse	Minor adverse
A45 Coventry Road eastbound on-slip at M42 junction 6	Moderate adverse	Moderate adverse	Moderate adverse
A45 Coventry Road westbound on-slip at Stonebridge Island	Minor adverse	Moderate adverse	Minor adverse
A45 Coventry Road eastbound off-slip at Stonebridge Island	Minor adverse	Moderate adverse	Minor adverse
A45 Coventry Road westbound off-slip at Stonebridge Island	Minor adverse	Moderate adverse	Minor adverse

12.4.25 Utilities works (including diversions) have been assessed in detail where they are major works and where traffic and transport impacts from the works separately, or in combination with other works, is greater than other construction activities arising within the area. Minor utilities works will be required but will only require short term lane or road closures. No additional significant effects from utilities works are expected.

12.4.26 There will be a temporary loss of car parking at several locations as a result of the Proposed Scheme. This includes a loss of private off-street car parking spaces and designated car parking spaces.

12.4.27 The construction of the people mover will result in the following temporary loss of car parking spaces:

- up to 720 car parking spaces (4%) at the NEC for up to 12 months;
- up to 290 spaces (13%) at Birmingham International station for up to two years;

[129] In the context of this Traffic and Transport section, severance is used to relate to a change in ease of access for non-motorised users due to, for example, a change in travel distance or travel time or a change in traffic levels on a route that makes it harder for non-motorised users to cross. A reference to severance does not imply a route is closed to access.

- approximately 200 spaces (8%) from the West Car Park for up to two years; and
- up to 280 designated spaces (2%) at Birmingham Airport for up to two years. This includes spaces in the taxi holding area and spaces for car hire.

12.4.28 There is a large amount of car parking in the local area around the NEC, Birmingham International station and Birmingham Airport, which could potentially be available as alternative car parking locations. In addition, detailed phasing of the works including temporary access could potentially reduce the loss of spaces and/or the duration over which spaces are lost. The effect from the loss of spaces at the NEC and the West Car Park will not therefore be significant. The loss of spaces at Birmingham International station is expected to have a minor adverse effect, and the loss of designated spaces at Birmingham Airport will have a moderate adverse effect.

12.4.29 The highway capacity improvements at the M42 junction 6 will require the relocation of the access to the National Motorcycle Museum, which will result in the temporary loss of approximately 55 car parking spaces. The effect of the temporary parking loss will be moderate adverse.

12.4.30 The construction of the new A452 Chester Road/ Solihull Parkway roundabout will result in a loss of approximately 37 car parking spaces at Fujitsu in the Birmingham Business Park. The effect will not be significant.

12.4.31 The realignment of the A446 Stonebridge Road will result in a loss of approximately 54 car parking spaces at Melbicks Garden and Leisure Centre. The effect of the temporary parking loss will be moderate adverse.

12.4.32 The effect on loading bays at the NEC and Birmingham Airport is not expected to be significant relative to the total number of loading areas at the facilities.

12.4.33 HS2 Ltd will work with the businesses affected to identify opportunities where reasonably practical to mitigate effects on parking by the use of land acquired for the Proposed Scheme.

12.4.34 The effect on accident and safety risks will not be significant. There are no locations where there are existing highway safety issues and where there will be substantial increases in traffic during construction.

12.4.35 Construction of the Proposed Scheme is not expected to have a significant effect on bus passenger delays due to diversions, as temporary road closures are only for short periods, overnight and at weekends.

12.4.36 Rail possessions will be required within this area and in adjoining CFAs. Disruption to rail users will be minimised by limiting possessions, where reasonably practical, to overnight, off-peak or weekend periods. There are not expected to be any significant effects on the travelling public from rail possessions or blockades in this area. Where necessary, rail replacement services will be provided.

12.4.37 Construction of the Proposed Scheme is not expected to result in any loss of pedestrian links at Birmingham International station, or any substantial loss of bus,

taxi or park and ride facilities at the station. The effect on the station interchange is therefore not expected to be significant.

12.4.38 There will be temporary realignments of five PRoW and the footpath around Pendigo Lake. Footpath M114 is diverted within the Balsall Common and Hampton-in-Arden area (CFA23) and will increase the travel distance by approximately 150m, but the realignment will not have a significant effect. The realignments of Footpaths M96, M104, M105 and M107 are likely to increase the travel distances by less than 50m and will not have a significant effect. The footpath around Pendigo Lake will be realigned to the south of the existing footpath and the effect will not be significant.

Cumulative effects

12.4.39 The assessment includes cumulative effects of planned development during construction by taking this into account within the background traffic growth and by taking into account developments at Birmingham Airport (runway extension), Birmingham Business Park (AEC) and the NEC (Resorts World).

12.4.40 The assessment also includes for in-combination effects by taking into account traffic and transport impacts of works being undertaken in neighbouring CFAs. Daily construction traffic flows of 1,545 cars/LGV and 1,768 HGV per day as generated from compounds in the adjacent Stoneleigh, Kenilworth and Burton Green area (CFA18), Balsall Common and Hampton-in-Arden area (CFA23), Coleshill Junction (CFA19), Castle Bromwich and Bromford area (CFA25) and Washwood Heath to Curzon Street area (CFA26), have been assigned across various routes in this area.

Permanent effects

12.4.41 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

12.4.42 The implementation of the draft CoCP (see Volume 5: Appendix CT-003-000) 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 the travel plan measures have not been included in the assessment as presented in this section, which will mean the adverse effects may be over-stated.

12.4.43 No further traffic and transport mitigation measures during construction of the Proposed Scheme are considered practicable, based on the outcomes of this assessment.

Summary of likely significant residual effects

12.4.44 The most intensive peak periods of construction will cause increases in traffic that will affect pedestrians and cyclists crossing the slip roads at the M42 junction 6 and Stonebridge Island, although the level of pedestrian and cycle use in this area is low.

12.4.45 Similarly there will be a temporary increase in traffic which will from time to time cause additional congestion and/or increase delays for road users on the M42, between junction 5 and the M6 on-slip roads; M42 junction 6 southbound on-slip; A45 Coventry Road between M42 junction 6 and Oak Lane; A45 Coventry Road westbound on-slip and eastbound off-slip at Stonebridge Island; A446 Stonebridge Road between M6 junction 4 and Stonebridge Island; A452 Chester Road, between Packington Lane and Stonebridge Island and the A45 Coventry Road, off-slip at M42 junction 6.

12.4.46 There will be a temporary loss of car parking at Birmingham International station, at Birmingham Airport (including taxi holding and car hire spaces), at the National Motorcycle Museum, and at Melbicks Garden and Leisure centre.

12.4.47 The significant effects that result from construction of the Proposed Scheme are shown on Maps TR-03-154 to TR-03-155a, 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:

- the design of the Birmingham Interchange station has been sized to include sufficient concourse and platform space to accommodate passenger growth to 2041 (which relates to the HS2 Phase Two) and beyond;
- the design of Birmingham Interchange station will include the following dedicated transport facilities which will be sufficient to accommodate the forecast levels of use, as shown on Map TR-01-024, Volume 5, Map Book Traffic and transport:
  - bus/coach stops;
  - taxi drop off and pick up area;
  - kiss and ride drop-off area;
  - car parking; and pedestrian and cycle facilities.
- a people mover to provide connectivity between Birmingham Interchange station, the NEC, Birmingham International station, Birmingham Airport and business parks in the area. The people mover has been designed to provide high capacity, fast and efficient connections, and to accommodate the changes in use of Birmingham International station, particularly given the reductions in use, with transfer of many longer distance passengers to the Proposed Scheme. The people mover will also provide a link to the existing bus routes serving Birmingham International station and Birmingham Airport;
- multiple access routes from the highway network including access via the M6 junction 4 for passengers from the north, access via M42 junction 6 for passengers from the south, and access from the A45 Coventry Road for passengers from the east and west;

- replacement of the A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout with new access roads and three new roundabouts to maintain access and connectivity;
- an underbridge at Coleshill Heath Road;
- an overbridge at the A45 Coventry Road, A45 Service Road and East Way; and
- upgraded highway capacity including improvements to the M42 junction 6, M6 junction 4 and Stonebridge Island.

12.5.2 A framework travel plan will set out how travel plans will be required to mitigate the impacts of traffic and transport movements associated with the maintenance and operation of the Proposed Scheme. In relation to this area, an operational station travel plan will be used to mitigate travel impacts from Birmingham Interchange station by, in particular, promoting the use of sustainable modes for both workers and passengers.

Assessment of impacts and effects

12.5.3 The following section considers the impacts on traffic and transport and the consequential effects resulting from the operational phase of the Proposed Scheme.

12.5.4 The operational traffic and transport impacts within this area are:

- increase in rail capacity between London and Birmingham;
- reduced rail journey times between London and Birmingham;
- passenger demands to/from the new Birmingham Interchange station and their associated access journeys;
- road closures and associated diversions around the new Birmingham Interchange station;
- reduction in parking at the NEC, Birmingham International station, Birmingham Airport, National Motorcycle Museum and Melbicks Garden and Leisure centre;
- reduction in loading area at the NEC and Birmingham Airport; and
- footpath realignment.

12.5.5 The total passenger demand, along with the number of people travelling by each mode of transport to/from Birmingham Interchange station is shown in Table 20.

Table 20: Approximate Birmingham Interchange station person trips per mode. (Note: Numbers are rounded).

Demand/ Mode	**2026 (Phase 1)**		**2041 (Phase 2)**	
	AM Peak Hour	**PM Peak Hour**	**AM Peak Hour**	**PM Peak Hour**
	Boarders/Alighters	**Boarders/Alighters**	**Boarders/Alighters**	**Boarders/Alighters**
Total HS2 Passengers	1950	2100	3450	3700
Car (parked)	930	1100	1620	1890

Demand/ Mode	2026 (Phase 1)		2041 (Phase 2)	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
	Boarders/Alighters	Boarders/Alighters	Boarders/Alighters	Boarders/Alighters
Total HS2 Passengers	1950	2100	3450	3700
Kiss and Ride	190	70	320	130
Taxi	100	190	180	330
People mover (comprising of):				
Bus	70	80	130	150
Walk / Cycle	140	100	240	180
Other Trains	440	470	820	880
People mover to Birmingham Airport	90	80	150	140

12.5.6 With the introduction of the Proposed Scheme in 2026, it is forecast that there will be approximately 1,950 passengers boarding, alighting and interchanging at Birmingham Interchange station in the morning peak hour and approximately 2,100 passengers boarding, alighting and interchanging in the evening peak hour. These passengers are forecast to generate around 1,350 vehicle movements in the morning peak hour and 1,100 vehicle movements in the evening peak hour.

12.5.7 For 2041, with the full Phase 2 operation, it is forecast that these numbers increase to approximately 3,450 passengers using Birmingham Interchange station in the morning peak hour and approximately 3,700 passengers in the evening peak hour through increased train frequency and additional national rail destinations. These passengers are forecast to generate around 2,300 vehicle movements in the morning peak hour and 1,950 vehicle movements in the evening peak hour.

12.5.8 The Proposed Scheme will generate significant major beneficial effects for rail passengers in the area in 2026 and 2041. They will benefit from an increase in rail capacity from the Proposed Scheme services and from significantly improved journey times between Birmingham and London, which is evidenced by the levels of use set out in Table 20.

12.5.9 With the introduction of Phase Two, the new links to Manchester and Leeds will result in substantial journey time and capacity benefits to these cities and intermediate stations, together with further opportunities to exploit released capacity to provide additional services and reduce crowding.

12.5.10 There will also be significant major beneficial effects to local commuters of released capacity on the existing rail network, including reduced crowding and the potential for additional services.

12.5.11 In 2026 and 2041, the primary benefits will be shorter journey times, increased reliability, reduced crowding, support for options for growth and increased access to wider national rail destinations.

12.5.12 The primary origins and destinations of the passengers boarding and alighting at Birmingham Interchange station are shown in Table 21, and these influence the modes and routes used by passengers to gain access to the station.

Table 21: Primary origin and destination of trips travelling through Birmingham Interchange and Chelmsley Wood

Origin/Destination	**2026**	**2041**
	Boarders/Alighters	**Boarders/Alighters**
Solihull, Warwick and Leamington	35%	34%
Kenilworth/Balsall Common	11%	11%
Coventry	10%	11%
Sutton Coldfield, Tamworth, Nuneaton	10%	11%
Birmingham	8%	8%
Other (less than 5% to any destination)	26%	24%

12.5.13 The Proposed Scheme includes the realignment and/or reconfiguration of highways around Birmingham Interchange station including the realignment of the A452 Chester Road, A446 Stonebridge Road, A45 Coventry Road, A45 Service Road, East Way and replacement of the A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout with three new roundabouts. Middle Bickenhill Lane will be partially closed and reconfigured as a cul-de-sac.

12.5.14 Operation of the Proposed Scheme will result in changes in daily traffic flows due to staff and passengers accessing Birmingham Interchange station, and the reconfiguration of the local road network.

12.5.15 The patterns of origins and destinations shown in Table 21 result in the main flows, particularly relevant to traffic impacts, being south towards Solihull, Warwick, Leamington, Kenilworth and Balsall Common, east towards Coventry, and north towards Sutton Coldfield, Tamworth and Nuneaton. This results in additional pressure on the A452 Chester Road and its junction with Stonebridge Island, the A45 Coventry Road, junction 6 of the M42 and junction 4 of the M6. These sections of the network will be under considerable pressure regardless of the Proposed Scheme, but the Proposed Scheme increases this. The proposed highway capacity improvements to the M42 junction 6, M6 junction 4, Stonebridge Island and the A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout are designed to ensure

that the Proposed Scheme does not, overall, have a detrimental impact on highway conditions.

12.5.16 The increases in traffic as a result of the Proposed Scheme are largely on the strategic road network.

12.5.17 The largest increases (greater than 10%) in peak hour traffic flows in 2026 and 2041 on the road network local to Birmingham Interchange station as a result of the Proposed Scheme are:

- M42 junction 6 northbound off-slip – traffic flows will increase in 2026 by approximately 18% in the morning peak hour, and in 2041 by approximately 28%;
- M6 junction 4 westbound on-slip – traffic flows will increase in 2026 by approximately 14% in the evening peak hour, and in 2041 by approximately 11% in the morning peak hour and by approximately 26% in the evening peak hour;
- A45 Coventry Road, between Clock Island and Stonebridge Island – traffic flows will increase in 2026 by up to approximately 13% in the morning peak hour, and in 2041 by up to approximately 22% and 15% in the morning and evening peak hour respectively;
- A45 Coventry Road eastbound on-slip and westbound off-slip at M42 junction 6 – traffic flows will increase in 2026 by up to approximately 24% in the morning peak hour and by approximately 19% in the evening peak hour, and in 2041 by between approximately 12% and 39% in the morning peak hour and by up to approximately 32% in the evening peak hour;
- A45 Coventry Road eastbound and westbound on/off-slips at Stonebridge Island – traffic flows will increase in 2026 by between approximately 13% and 44% in the morning peak hour and between approximately 12% and 37% in the evening peak hour, and in 2041 by between approximately 22% and 72%, and 22% and 63% respectively;
- A446 Stonebridge Road, between M6 junction 4 and the merge with the A452 Chester Road – traffic flows will increase in 2026 by up to approximately 24% in the morning peak hour and by up to approximately 19% in the evening peak hour, and in 2041 by up to approximately 43% and 36% respectively;
- A452 Chester Road Between Packington Lane and Stonebridge Island – traffic flows will increase in 2026 by approximately 24% in the morning peak hour and by approximately 18% in the evening peak hour, and in 2041 by approximately 41% and 31% respectively;
- B4438 Bickenhill Parkway, between Northway and the new A452 Chester Road/Solihull Parkway roundabout – traffic flows will increase in 2026 by approximately 161% in the morning peak hour and by approximately 103% in the evening peak hour, and in 2041 by approximately 161% and 105% respectively. The increases are primarily due to the reconfiguration of the road network;

- Northway, between the North Car Park Roundabout and Bickenhill Parkway – traffic flows will increase in 2026 and 2041 by approximately 25% in the morning peak hour and by approximately 26% in the evening peak hour; and
- Damson Parkway – traffic flows will increase in 2041 by approximately 11% in the morning peak hour.

12.5.18 The increased traffic flows will have a minor adverse effect on severance for non-motorised users in 2026 and 2041 at the following locations:

- M42 junction 6 southbound on-slip;
- M6 junction 4 westbound on-slip;
- A45 Coventry Road eastbound on-slip at M42 junction 6;
- A45 Coventry Road westbound on/off slip and eastbound off-slip at Stonebridge Island;
- A446 Stonebridge Road, between the M6 junction 4 and the new A452/A446 roundabout;
- B4438 Bickenhill Parkway between Northway and the new A452 Chester Road/Solihull Parkway Roundabout;
- Northway between North Car Park and B4438 Bickenhill Parkway; and
- Damson Parkway.

12.5.19 The increases in traffic and consequential effects on the A452 Chester Road, A446 Stonebridge Road, A45 Coventry Road and associated junctions are mainly due to the impact of traffic accessing the Birmingham Interchange station, although there are some localised effects caused by the reconfiguration of highways around the new A452/A446 roundabout.

12.5.20 To mitigate the effects of the increased traffic flows on congestion and delays in 2026 and 2041, works are proposed on the primary station access routes, including the A452 Chester Road, Stonebridge Island, M42 junction 6, A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout and M4 junction 6, as described in Section 2. The improvements are proposed on the road network closest to the station, beyond which traffic will be dispersed.

12.5.21 The road network with the proposed mitigation and the traffic generated by the Proposed Scheme would perform at a similar level to that which would occur without the Proposed Scheme and the improvements. The predicted queues and delays across the network and at key junctions are forecast to be similar to the future baseline operation in 2026 and 2041. The one exception is at the A452 Chester Road/Coleshill Heath Road junction. At this location, queues are predicted to increase, but overall journey times are not expected to be significantly different.

12.5.22 Overall, with the proposed highway improvements, the average travel times and journey time delays for vehicles through the area will be similar to those forecast in the future baseline for 2026 and 2041. The forecast increases in traffic during the

morning and evening peak hours will not therefore have a significant effect on congestion and delays in either 2026 or 2041.

12.5.23 The maintenance of the Proposed Scheme will generate limited vehicular trips and the effect will not be significant.

12.5.24 The closure of Middle Bickenhill Lane is likely to result in a diversion of between 1.5km and 2.5km depending on the direction travelled. The diversion will have a minor adverse effect on journey times. The reconfiguration of the road network around the A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout will result in a diversion of up to 1.5km, depending on the origin and destination of the journey. The reconfiguration will have a moderate adverse effect on journey times, although this will only affect a small number of users.

12.5.25 There will be a permanent loss of car parking at a number of locations. This includes a loss of private off-street car parking spaces, designated car parking spaces and loading bays.

12.5.26 The precise loss of car parking at the NEC, Birmingham International station and the West car park will depend on the detailed design and spacing of the people mover supporting structures, and the redesign of parking areas below. It is estimated that the following car parking spaces will be permanently lost as a result of the people mover:

- approximately 96 car parking spaces (0.5%) at the NEC (not significant);
- approximately 92 spaces at Birmingham International station. This includes a loss of 88 spaces in the main passenger car park (4%), and a loss of four spaces in the Network Rail staff car park (6.7%) – not significant;
- approximately 16 spaces (0.3%) from the West Car Park (not significant); and
- approximately 16 designated taxi holding spaces (30.8%) at Birmingham Airport (moderate adverse effect).

12.5.27 The M42 junction 6 capacity improvements will result in a permanent loss of approximately 45 car parking spaces at the National Motorcycle Museum. The effect will be moderate adverse.

12.5.28 The realignment of the A446 Stonebridge Road will result in a loss of approximately 45 car parking spaces at Melbicks Garden and Leisure centre. The effect is not expected to be significant.

12.5.29 There may be a loss of loading bays at the NEC and Birmingham Airport, but this is not expected to have a significant effect relative to the total number of loading areas at these facilities.

12.5.30 HS2 Ltd will work with the businesses affected to identify opportunities where reasonably practicable to mitigate effects on parking.

12.5.31 The effect on accident and safety risks is not significant as there are no locations where there are existing highway safety issues and substantial increases in traffic due to the operation of the Proposed Scheme.

12.5.32 The Proposed Scheme will include facilities to enable bus services to stop at Birmingham Interchange station. It is expected that the majority of bus users will be from Solihull (50-60%) and Birmingham (25-35%) in the peak hours reflecting the pattern of origins and destinations. For onward travel by public transport it is expected that commercial operators would take the opportunity to develop new services that would meet the new demands from the local area.

12.5.33 Reconfiguration of the A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout will reduce travel distance for the 777 bus route due to the replacement of the large five-arm roundabout that bridges the M42, with a small three-arm roundabout. The northbound route is little different but the southbound route distance is reduced by some 700m. This will be a minor beneficial effect on bus passenger delay.

12.5.34 The Proposed Scheme will result in the realignment of one PRoW (FP M107). The realigned PRoW is likely to result in an increased travel distance of approximately 30m and the effect on users will not be significant.

12.5.35 There will be 8 roads realigned. Most are associated with the replacement of the existing A452 Chester Road/A446 Stonebridge Road/Solihull Parkway roundabout which is removed to accommodate the Proposed Scheme and is replaced by three junctions resulting in increased walking distances of up to 1.3km. As a consequence of the increased travel distance, there will be a moderate adverse effect on non-motorised users of the A452 Chester Road, A446 Stonebridge Road, B4438 Bickenhill Parkway and Solihull Parkway. The increased travel distance would only affect users travelling from east to west across the Proposed Scheme.

12.5.36 There will also be a moderate adverse effect on non-motorised users of Middle Bickenhill Lane as a result of the increased travel distance caused by the road closure.

12.5.37 There will be a minor adverse effect on journey ambience as a result of the closure of Middle Bickenhill Lane, due to pedestrians having to divert along the A45 Coventry Road and A452 Chester Road.

Cumulative effects

12.5.38 The assessment includes the cumulative effects of planned development during operation by taking this into account within the background traffic growth and by taking into account developments at Birmingham Airport (runway extension), Birmingham Business Park (AEC) and the NEC (Resorts World).

12.5.39 The assessment also includes in-combination effects, by taking into account traffic and transport movements which pass through the area to access the proposed Curzon Street station and Washwood Heath depot. In 2026, this equates to 37 vehicle movements from neighbouring CFAs in the morning peak hour and 34 in the evening peak hour. For 2041, traffic flows of 39 (morning peak) and 38 (evening peak) have been included in the assessments. The traffic flows are assigned across various routes in this area.

Other mitigation measures

12.5.40 The strategy and opportunities for providing bus connections to the Birmingham Interchange station and how these relate to existing services, will be explored with the transport authorities nearer to the year of opening, as the existing bus service provision in the local area, upon which re-routeing of services will be based, is likely to change in the intervening 15 year period.

12.5.41 Potential improvements to the signal timings at the A45 Coventry Road/Damson Parkway junction will be discussed with the highway authorities. Potential improvements have not been taken account in the assessment but would help mitigate the Proposed Scheme effects.

12.5.42 Potential highway improvements (within the highway boundary) to manage the flow of traffic on Coleshill Heath Road will be discussed with the highway authorities. Any potential mitigation scheme has not been taken into account in the assessment but would help mitigate the Proposed Scheme effects.

12.5.43 The framework travel plan will require travel plans to be used to mitigate the impacts of traffic and transport movements associated with the maintenance and operation of the Proposed Scheme. The effects of the travel plan measures for the station at Birmingham Interchange have not been included in this assessment, which will mean the adverse effects may be over-stated.

12.5.44 No further mitigation measures for the operation of the Proposed Scheme are considered necessary based on the outcomes of this assessment.

12.5.45 Future development proposals for the area such as UK Central include ambitious proposals for new development and supporting transport proposals, which may offer opportunities for improving access and local transport conditions. HS2 Ltd will continue to work with other stakeholders to develop such proposals that offer additional mitigation and improvement opportunities.

Summary of likely significant residual effects

12.5.46 The Proposed Scheme will have major significant beneficial effects on rail users. This will include the new rail capacity on the Proposed Scheme and associated substantial reductions in journey times between Birmingham and London. The capacity released on the WCML will reduce crowding on local services and provide the opportunity to operate additional services. In addition, the Proposed Scheme will provide high capacity, fast and efficient connectivity via the people mover to the NEC, Birmingham International station, Birmingham Airport and business parks in the area.

12.5.47 Closure of Middle Bickenhill Lane will increase journey times for road users and increase travel distances and reduce amenity for non-motorised users due to the diversion required.

12.5.48 The reconfiguration of highways at the A452 Chester Road/A446 Stonebridge Road/ Solihull Parkway roundabout to accommodate the Proposed Scheme will result in increased travel times for road users due to the extended travel distances. The reconfiguration of the highway will increase severance for pedestrians and cyclists due to increased distances between the A452 Chester Road, A446 Stonebridge Road,

B4438 Bickenhill Parkway and Solihull Parkway. The reconfiguration of the highway will however benefit users of bus route 777 which will have a reduced travel distance.

12.5.49 There will be an increase in traffic associated with travel demand to and from Birmingham Interchange station. The increase in traffic will not have a significant effect on overall travel conditions in the area but will affect pedestrians and cyclists crossing the slip roads at M42 junction 6, M6 junction 4 and Stonebridge Island; the A446 Stonebridge Road between the M6 junction 4 and the new A452 Chester Road/ A446 Stonebridge Road roundabout; the B4438 Bickenhill Parkway between North Way and the new A452 Chester Road/Solihull Parkway roundabout; North Way between North Car Park and Bickenhill Parkway; and Damson Parkway. The effect is expected to be minor due to the low level of pedestrian and cycle users in this area.

12.5.50 There will be a permanent loss of taxi spaces at Birmingham Airport, and car parking spaces at the National Motorcycle Museum.

12.5.51 The significant effects that result in this area from the Proposed Scheme in 2026 and 2041 are shown on Maps TR-04-154 to TR-04-155 (Volume 5, Map Book Traffic and transport).

13 Water resources and flood risk assessment

13.1 Introduction

13.1.1 This section provides a description of the current 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 include:

- the River Blythe and Hollywell Brook and their associated floodplains, and Pendigo Lake and the unnamed ordinary watercourse near Denbigh Spinney;
- Coleshill and Bannerly Pools Site of Special Scientific Interest (SSSI) and the River Blythe SSSI;
- two Secondary A aquifers, the permeable superficial deposits and the Arden Sandstone Formation, and one Secondary B aquifer, the Mercia Mudstone Formation; and
- one licensed groundwater abstraction[130], within 1km of the route, which abstracts directly from the Mercia Mudstone Group (most probably from the Arden Sandstone Formation).

13.1.3 Key environmental aspects relating to water resources and flood risk include:

- the potential for lowering of groundwater levels and disturbance of any existing poor-quality groundwater in the permeable superficial deposits, Arden Sandstone Formation and Mercia Mudstone Formation aquifers by temporary dewatering during construction and by permanent groundwater control during operation. The potential receptors are the River Blythe, and the permeable superficial deposits, Arden Sandstone Formation and Mercia Mudstone Formation aquifers;
- the potential for obstruction of groundwater flow by below ground construction and permanent structures, such as Diddington and Bickenhill cuttings, on the permeable superficial deposits, Arden Sandstone Formation and Mercia Mudstone Formation aquifers;
- the potential for the creation or alteration of contaminant pathways during construction and operation and subsequent effects on groundwater and surface water quality e.g. the River Blythe, the permeable superficial deposits, Arden Sandstone Formation and Mercia Mudstone Formation aquifers; and

[130] Environment Agency (2012). Abstraction licences data.

- the realignment of Hollywell Brook in the area of the proposed Birmingham Interchange station.

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[131] compliance assessment; and
- a route-wide Flood Risk Assessment (FRA).

13.1.5 Detailed reports on water resources and flood risk within the area are also contained in the Volume 5 Appendices. These include:

- Volume 5: Appendix WR-002-024: Water Resources Assessment report;
- Volume 5: Appendix WR-003-024: Flood Risk Assessment;
- Volume 5: WR-004-016: River Blythe catchment preliminary flow calculations technical report; and
- Volume 5: WR-004-018: River modelling of Bayleys Brook (at Marsh Farm and Lavender Hall Lane), the River Blythe Bypass, Shadow Brook and Hollywell Brook technical report.

13.1.6 Map series WR-01, WR-02, WR-03, WR05 and WR-06 show details referred to in this report and are contained in the Volume 5, Map Book Water resources.

13.1.7 Discussions have been held with the Environment Agency, Natural England, Solihull Metropolitan Borough Council (SMBC), Severn Trent Water Ltd and the Canal and 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 and in the Scope and Methodology Report (SMR), its addendum and appendices presented in Volume 5: Appendix CT-001-000/1 and CT-001-000/2. 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 centreline of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban

[131] *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.

areas, the extent was reduced to 500m. 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 centreline, for 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 spatial scope is defined as the study area.

13.2.3 Site visits were carried out for locations along the route to view the River Blythe and the associated floodplain and also to the Hollywell Brook to view the area of the proposed river realignment, culverts, local landform and existing structures.

13.2.4 Baseline surface water levels, flows and quality have not been monitored as part of this assessment. The assessment is based upon flows provided by publicly available data from the National Rivers Flow Archive[132] for the study area catchments.

13.2.5 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 tables in Table 23 below and Volume 5: Appendix (WR-002-024).

13.2.6 The key assumptions for water resources and the FRA specific to this area are as follows:

- the Hollywell Brook interacts with groundwater in a similar manner to the River Blythe (the brook, like the River Blythe, acts as a discharge point for converging groundwater flows);
- the Coleshill and Bannerly Pools SSSI[133] and River Blythe SSSI[134] are at least partially groundwater dependent; and
- in the absence of any river models for the River Blythe and its tributaries, site specific hydraulic models have been developed to assess baseline and post development flood risk (see Volume 5: Appendix WR-004-018).

13.2.7 The main limitations for the water resources and FRA in this area are:

- there is limited published information available on the groundwater dependency or hydraulic functioning of the wetland areas of Coleshill and Bannerly Pools SSSI and River Blythe SSSI;
- no monitoring of levels, flows or quality for groundwater or surface water has been undertaken;

[132] Centre for Ecology and Hydrology; National River Flow Archive; http://ceh.ac.uk/data/nrfa; Accessed: 2013
[133] NRA (Severn Trent Region) (1995), Hydrogeological Assessment of Sites of Special Scientific Interest Final Report: Coleshill and Bannerly Pools.
[134] NRA (Severn Trent Region) (1998), Hydrogeological Assessment of Sites of Special Scientific Interest Final Report: River Blythe.

- floodplain modelling is based on Light Detection and Ranging (LiDAR) survey data and no surveys of existing structures have been undertaken; and
- all limitations related to flood models are presented in the Flood Risk Assessment Volume 5: Appendix WR-003-024.

13.2.8 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.

13.2.9 Notwithstanding the limitations outlined above, it is considered that an appropriate level of assessment has been undertaken and the conclusions drawn are valid.

13.3 Environmental baseline

Existing baseline – Surface water resources

Surface water features

13.3.1 All water bodies within this study area fall in a sub-catchment that includes the River Blythe and Hollywell Brook, within the Tame, Anker and Mease catchment. This sub-catchment falls within the Humber River Basin District as set out within the River Basin Management Plan (RBMP)[135].

13.3.2 The upper area of the Hollywell Brook catchment consists of the built up areas of the National Exhibition Centre (NEC), and associated development. Additionally there are major transport networks passing through the study area, for example the M42, A45 Coventry Road, and A452 Chester Road which drain into the River Blythe and its tributaries. The River Blythe within the study area is largely associated with rural land use.

13.3.3 The River Blythe is classified as a main river, with its tributary the Hollywell Brook being a main river downstream of Pendigo Lake. Pendigo Lake is a man-made lake within the NEC complex.

13.3.4 The current surface water baseline is shown on Map WR-01-041, Volume 5, Map Book Water resources, and all surface water features within the study area are assessed within Volume 5: Appendix WR-002-024. Table 22 includes features potentially affected by the Proposed Scheme.

[135] Environment Agency (2009), River Basin Management Plan Humber River Basin District.

Table 22: Surface water features potentially affected by the Proposed Scheme

Water feature	Location description (map reference)*	Watercourse classification[136]	WFD water body and current overall status	WFD status objective (by 2027** as per RBMP)	Receptor value[137]
River Blythe	Flowing northwards to the east of the study area (SWC-023-004)(J6 to B1)	Main river	Moderate (GB104028042572)	Good	Very high
Hollywell Brook	Flowing east from Pendigo Lake towards the River Blythe (SWC-CFA24-01) (G7 to G4)	Main river	No status shown in RBMP – assumed status is Moderate	Good	Very high
Unnamed watercourse at Denbigh Spinney	Flowing east from an area north-east of the NEC to the River Blythe (SWC-CFA24-02),(E6 to G4,)	Ordinary watercourse	No status shown in RBMP – assumed status is Moderate	Good	Very high
Pendigo Lake	The source of Hollywell Brook (Map WR-01-040, G7)	N/a	No status shown in RBMP – assumed status is Moderate	Good	High

* See Map WR-01-041, Volume 5, Map Book Water resources

**year may vary in different RBMPs

13.3.5 The River Blythe, identified as a receptor of very high value due to its SSSI status, is not crossed by the route in this area, although works at Stonebridge Island are proposed within the floodplain and in close proximity to the river. The other watercourses: Hollywell Brook; an unnamed watercourse at Denbigh Spinney; and Pendigo Lake, are not assessed under the WFD. These are identified as receptors of very high and high value due to their direct connection with the River Blythe and adoption of the assessment methodology.

Water Framework Directive status

13.3.6 The Environment Agency has set the overall status objective under the WFD for the River Blythe by 2027 to be improved to Good status from its current Moderate status.

[136] 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), Her Majesty's Stationery Office, 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.
[137] For examples of receptor value see Table 43 in the SMR.

Abstractions and permitted discharges

13.3.7 There are no licensed surface water abstractions within the study area[138].

13.3.8 The Environment Agency reports that there are 10 current consented surface water discharges within the study area. There is one licensed soakaway to ground at the site of the Quartz Point business park (the former Brackenlands Farm landfill). There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20 cubic metres per day. Details of discharge consents are provided in Volume 5: Appendix WR-002-024.

Existing baseline – groundwater resources

Geology and hydrogeology

13.3.9 The location of abstractions, geological formations and indicative groundwater elevations, where available, are shown on Map WR-02-024, Volume 5, Map Book Water resources.

13.3.10 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 23. Unless otherwise stated, the geological groups listed are all crossed by the route.

Table 23: Summary of geology and hydrogeology in the study area

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 sands and gravels	Across the upper slopes of the River Blythe valley.	Poorly sorted, sand, clayey sand, pebbly sand and gravel.	Secondary A[139]	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
Alluvium	Linear deposits along the River Blythe and Hollywell Brook.	An upper layer of clay or silt, underlain by several metres of pebbly sand and gravel.	Secondary A	Not assessed by the Environment Agency	Not assessed by the Environment Agency	Moderate
River terrace deposits	Small linear deposits along the River Blythe.	Sand and gravel, locally with lenses of silt, clay or peat.	Secondary A	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Moderate

[138] Water supply abstractions are not included.
[139] "Permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers" (Environment Agency (2012), http://www.environment-agency.gov.uk; Accessed: June 2013).

Geology **	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027* as per RBMP)	Receptor value
Glaciolacustrine	Deposit near Birmingham Business Park forms the southern part of an extensive area of glaciolacustrine material deposits extending northwards towards Coleshill.	Interbedded silt and clay.	Secondary A	Not assessed by the Environment Agency.	Not assessed by the Environment Agency.	Moderate
Bedrock						
Mercia Mudstone Formation (Mercia Mudstone Group)	Beneath superficial deposits across much of the study area.	Mudstone and dolomitic siltstone	Secondary B[140]	Poor[141]	Tame, Anker and Mease – Secondary Combined[142] – Good	Moderate
Arden Sandstone Formation (Mercia Mudstone Group)	Thin horizon within Mercia Mudstone. Known to be present near Diddington cutting and people mover.	Siltstones and sandstones; local beds of conglomerate.	Secondary A	Poor	Tame, Anker and Mease – Secondary Combined – Good	Moderate

*year may vary in different RBMPs

* See Map WR-02-024, Volume 5, Map Book Water resources

Superficial deposits

13.3.11 There are known areas of made ground identified within the study area which are associated with infrastructure development including:

- unsuitable material from the construction of the M42;
- earthworks associated with the dismantled Hampton-in-Arden to Shustoke line at Middle Bickenhill;

[140] "Predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering" (Environment Agency (2012). http://www.envrionment-agency.gov.uk; Accessed: June 2013).
[141] Environment Agency (2008); *The Tame, Anker and Mease Catchment Abstraction Management Strategy*; Environment Agency.
[142] Environment Agency (2009); *River Basin Management Plan Humber River Basin District*; Environment Agency.

- excavated material from a balancing pond to the west of Middle Bickenhill Lane;
- a borrow pit from the construction of the M42 between the M42 and Middle Bickenhill Lane; and
- deposits to the west of the M42 associated with the construction of the NEC, Birmingham International station and Birmingham Airport.

13.3.12 Superficial glacial deposits are present across much of the study area. Most of the glacial deposits beneath the route are sands and gravels, which are extensive but not continuous. Superficial glacial deposits, beneath the axis of the River Blythe valley constitute a significant local aggregate resource. A dissected layer of glacial till (generally brown silty or sandy clay) overlies the glacial sand and gravel which is generally a firm to stiff brown silty or sandy clay with many clasts of quartzite. Fluvial/alluvial deposits are present across lower parts of the River Blythe and Hollywell Brook valleys that cross the route. A discontinuous cover of superficial glacial deposits (mainly sand and gravels) and very locally alluvium is located in close proximity to the people mover (see Map WR-02-024, Volume 5, Map Book Water resources).

13.3.13 There is one category of aquifer identified within the superficial deposits in the study area. The Glaciofluvial deposits, the river deposits and alluvium are all classified as Secondary A aquifers (see Map WR-02-024, Volume 5, Map Book Water resources).

13.3.14 There are no superficial groundwater source protection zones (SPZs) located within the study area.

Bedrock aquifers

13.3.15 Mercia Mudstone underlies much of the study area. Mercia Mudstone typically comprises weak red brown silty mudstone with minor amounts of carbonate and gypsum when unweathered. Occasional beds of dolomitic siltstone occur within the Mercia Mudstone, which are generally thin and when unweathered are a medium strong rock. Within the Mercia Mudstone sequence, in the vicinity of the people mover, a thicker horizon of interbedded sandstone, siltstone and mudstone, known as the Arden Sandstone occurs (see Map WR-02-024, Volume 5, Map Book Water resources).

13.3.16 There are two categories of bedrock aquifer identified within the study area. The Arden Sandstone is classified as Secondary A aquifer and Mercia Mudstone is classified as a Secondary B aquifer (see WR-02-024, Volume 5, Map Book Water resources).

13.3.17 There are no bedrock groundwater SPZs located within the study area.

13.3.18 The geological formations within this study area are described in land quality (Section 8), and further details are included in Volume 5: Appendix WR-002-024.

Water Framework Directive status

13.3.19 No WFD classification has been given by the Environment Agency to the superficial deposits.

13.3.20 The study area is located within the Tame, Anker and Mease – Secondary Combined groundwater body. The current overall WFD status of groundwater in the study area is summarised in Table 23 and is largely classified as at Risk, with Poor Status (see Map WR-03-041, Volume 5, Map Book Water resources).

13.3.21 The main pressures identified across the whole of the catchment are high, or rising, nitrate concentrations and failures for pesticides and for chemicals associated with historic mine workings[143].

Abstractions and permitted discharges

13.3.22 The Environment Agency reports that there is one licensed groundwater abstraction within the study area. The abstraction comprises two boreholes, both located 30m and 110m east from the route, which extract groundwater from the Mercia Mudstone for agricultural purposes at Melbicks Garden and Leisure centre. The abstraction is classified as a high value receptor (see Map WR-02-024, E6, Volume 5, Map Book Water resources). There are no SPZs associated with the abstractions in this study area. Further detail is included in Volume 5: Appendix WR-002-024.

13.3.23 The Environment Agency reports that there are four current consented discharges to groundwater within 1km of the Proposed Scheme in the study area. Further detail is provided in Volume 5: Appendix WR-002-024.

Surface water/groundwater interaction

13.3.24 Five springs of moderate value have been identified within the study area in close proximity to the route. These springs are considered as surface expressions of the water body. The water body is considered as a receptor and as such the springs are not considered as receptors in their own right as changes to the local water body are likely to be reflected at the springs. The springs are located at:

- Middle Bickenhill, located approximately 280m north-east of the centreline of the route (see Map WR-01-041, G6, Volume 5, Map Book Water resources);
- at Jacksons Brickworks, near Pasture Farm, located approximately 190m south-west of the centreline of the route (see Map WR-01-041, G8, Map Book Water resources);
- at Park Farm, located approximately 150m south-west of the centreline of the route (see Map WR-01-041, G5, Volume 5, Map Book Water resources);
- at Pendigo Lake, located approximately 1km south-west of the centreline of the route (see Map WR-01-041, G7, Volume 5, Map Book Water resources); and

[143] Environment Agency (2009); *River Basin Management Plan Humber River Basin District*; Environment Agency.

- near the M42 junction 7a/M6 junction 4, located approximately 300m east of the centreline of the route (see Map WR-01-041, D5, Volume 5, Map Book Water resources).

13.3.25 The River Blythe is likely to act as a discharge point for converging groundwater flows in the region. The permeable superficial deposits underlying the river are likely to allow significant inflow of shallow groundwater. The River Blythe is classified as a very high-value receptor.

Water dependent habitats

13.3.26 There are two designated SSSI within the study area: Coleshill and Bannerly Pools SSSI (see Map WR-03-41, E5 and E4, Volume 5, Map Book Water resources) and the River Blythe SSSI (see Map WR-03-041, H5 to E2, Volume 5, Map Book Water resources). These designated sites contain wetland areas which are considered to be at least partially groundwater dependent and, therefore, to be groundwater dependent terrestrial ecosystems (GWDTEs)[144]. Coleshill and Bannerly Pools SSSI and the River Blythe SSSI are classified as very high value receptors.

13.3.27 Further information on the above ecological receptors is given in Ecology (Section 7).

Existing baseline – flood risk

River flooding

13.3.28 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping[145].

13.3.29 The River Blythe, a main river, is located to the east of the route in this study area (no elements of the Proposed Scheme cross the river in this area). At its closest, the route will be 600m from the floodplain of the River Blythe. In the area of the A45 Coventry Road / A452 Chester Road Stonebridge Island roundabout modifications, the River Blythe will be approximately 20m from the roundabout, with some proposed works being located within the area at risk of river flooding.

13.3.30 The Environment Agency Flood Zone mapping indicates that the area at risk of flooding from the River Blythe is located to the east of the route. This is shown on Map WR-01-041, Volume 5, Map Book Water resources.

13.3.31 The Environment Agency does not have an existing model of the River Blythe catchment, which includes the Hollywell Brook. Therefore, in order to better understand the existing risk posed by the River Blythe catchment, hydraulic models for key locations of the river were created. Further details on the baseline modelling are presented in the FRA in Volume 5: Appendix WR-003-024. The results of the baseline modelling within the FRA confirm that river flooding will impact on predominantly agricultural land in the vicinity of the River Blythe. The FRA, in Volume 5: Appendix WR-003-024, provides further details of receptors within the flood zones and their vulnerability, and these areas are shown on Maps WR-05-154 and WR-06-

[144] A GWDTE is a wetland ecosystem on the land surface that is directly dependent on a groundwater body and which is not part of a surface water body.
[145] See Map WR-01-41 Volume 5, Map Book Water resources.

154, WR-06-154-L1 and WR-06-155a, Volume 5, Map Book Water resources. The upstream reach of the Hollywell Brook is heavily attenuated by a man-made online lake (Pendigo Lake) built as part of the NEC complex drainage network. The route of the main line will cross Hollywell Brook, to the east of the NEC complex, on approach to the Birmingham Interchange station. This is shown on Map WR-01-041, Volume 5, Map Book Water resources.

13.3.32 The people mover will cross Hollywell Brook twice on its route west from Birmingham Interchange station to Birmingham Airport. The results of the site specific modelling (see Map WR-05-154, Volume 5, Map Book Water resources) show the extent of the floodplain for a 1 in 100 annual probability (1%) river flooding event plus climate change associated with the Hollywell Brook. This extent is shown to comprise the agricultural land up to approximately 100m from the channel in the area downstream of Pendigo Lake and towards its confluence with the River Blythe. The area at risk of flooding also includes the A452 Chester Road.

13.3.33 The northern section of the route will pass adjacent to the A452 Chester Road before moving to the boundary of the area in close proximity to junction 4 of the M6. The River Cole is considered to be hydrologically outside the study area as the northern boundary of this study area is coincident with a surface water divide between the Cole and Blythe sub-catchments. The Environment Agency Flood Zone mapping indicates that this section of the route near the study area boundary is at low risk of flooding from rivers.

Surface water flooding

13.3.34 The agreed data set for surface water flooding is the Environment Agency Flood Maps for surface water (FMfSW) as shown on Map WR-01-041, Volume 5, Map Book Water resources.

13.3.35 The SMBC Preliminary Flood Risk Assessment (PFRA)[146] along with other documents and information sources identified in Volume 5: Appendix WR-003-024 has been reviewed to form the basis of the assessment for the impact on the risk of surface water flooding. No historic flooding incidents have been recorded in the vicinity of the Proposed Scheme.

13.3.36 The FRA in Volume 5: Appendix WR-003-024 presents Environment Agency maps showing areas susceptible to surface water flooding. The one in 200-year annual probability event is illustrated on Map WR-01-041, Volume 5, Map Book Water resources. The maps show areas currently at risk of surface water flooding. Surface water is generally collected in rural low points in topography. There are areas at risk of surface water flooding associated with the existing surface water channels such as Hollywell Brook, ponding of water behind the A45 Coventry Road, ponding between the Packington Estate and the A452 Chester Road, and flow of water along the M42 corridor.

[146] Solihull Metropolitan Borough Council (2011), *Preliminary Flood Risk Assessment.*

Sewer flooding

13.3.37 The agreed data set for historical incidents of sewer flooding is the SMBC PFRA and the SMBC Strategic Flood Risk Assessment (SFRA)[147]. No historic flooding incidents have been recorded in the vicinity of the Proposed Scheme.

13.3.38 The south of the study area is a semi-rural area, passing into a more developed environment. Due to the largely rural location there are only localised sewer networks through this area. The majority of the drainage systems are the responsibility of Severn Trent and SMBC for highway drainage. There are no significant interactions between the Proposed Scheme and the existing sewerage network within this study area.

13.3.39 The triangle of land where the Birmingham Interchange station will be located comprises mainly farm land, with some isolated properties along the A452 Chester Road and Middle Bickenhill Lane. The southern area is a valley which drains to the Hollywell Brook, and the northern plateau drains an area around Denbigh Spinney into an unnamed watercourse. This area is rural with no public foul or surface water sewers. The nearest foul sewer connections are at the National Motorcycle Museum, and Birmingham Business Park.

Artificial water bodies

13.3.40 The agreed data set for flooding from reservoirs is the Environment Agency Reservoir Inundation Map.

13.3.41 Flooding from artificial systems may occur from failure of a retaining structure which impounds water. The following man-made features have been identified within the FRA Volume 5: Appendix WR-003-024 as being a potential source of flood risk:

- the canal system; and
- reservoirs.

13.3.42 The nearest canal to the route in this study area is the Grand Union Canal, which is located 3.6km to the south-west of the study area from the A45 Coventry Road. Due to the distance from the Proposed Scheme, canals are not discussed further as a potential source of flood risk, as a breach will not affect key receptors in the study area.

13.3.43 The probability of flooding occurring from the failure of a reservoir or large water body created by impoundment of water, or by a dam or other retaining structure is extremely low. The Environment Agency's website reports that there has been no loss of life due to reservoir failure in the UK since 1925. The Environment Agency's reservoir failure mapping for the area has been compared to the Proposed Scheme alignment.

13.3.44 There are six water bodies that are listed in the Environment Agency Reservoir Inundation Flood mapping[148] as posing a potential flood risk to the River Blythe

[147] Solihull Metropolitan Borough Council (2008), *Strategic Flood Risk Assessment.*

catchment in the vicinity of the Proposed Scheme. These are Earlswood Lakes (near Earlswood), Meriden No. 1 and No. 2 Service Reservoirs, Geary's Level and Molands Lake (the latter are all near Meriden), and Pendigo Lake.

13.3.45 The mapping shows the largest area that might be flooded if a reservoir were to fail. The mapping indicates that in the event of a catastrophic failure of any of the six water bodies in the River Blythe catchment listed above, the flood waters would flow down the river channels and extend out across the floodplain.

13.3.46 The likelihood of such flooding occurring is extremely low, in the event of it occurring it is anticipated that it will be contained within the extents of the 1 in 100 annual probability plus climate change (1%) river flood event. Thus it will not increase the residual risk, and it has not been considered further within this assessment. Further details can be found in the FRA, Volume 5: Appendix WR-003-024.

Groundwater flooding

13.3.47 The agreed dataset for historical incidents of groundwater flooding is the SMBC SFRA and the PFRA.

13.3.48 The SMBC SFRA states that groundwater is not considered to pose a significant risk of flooding in the area.

Future baseline

13.3.49 Volume 5: Appendix CT-004-000 identifies 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 the assessment of the construction and operation of the Proposed Scheme.

13.3.50 All developments are required to comply with the National Planning Policy Framework (NPPF)[149] development plans and other legislation and guidance. As such committed developments should have a neutral effect on the water resources and flood risk baseline.

13.3.51 There are no committed developments that are likely to cause significant changes to the water resources and flood risk baseline prior to construction of the Proposed Scheme in this study area.

13.3.52 WFD future status objectives are set out in Table 22 and Table 23. These changes are not considered to result in significant changes to the reported effects from the Proposed Scheme changing in significance.

[148] Environment Agency; (2012), Risk of flooding from reservoirs, http://www.environment-agency.gov.uk/homeandleisure/37793.aspz; Accessed on 8 January 2013.
[149] Department for Communities and Local Government (2012) National Planning Policy Framework Technical Guidance

Climate change

13.3.53 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 below, these changes are not considered to result in the reported effects from the Proposed Scheme changing in significance.

13.3.54 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.

13.3.55 When considering the influence that climate change may have on the future baseline against which impacts from the Proposed Scheme on flood risk have 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[150]. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.

13.3.56 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.

13.4.2 The following examples illustrate how avoidance and mitigation 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-002-024 and WR-003-024.

13.4.3 Mitigation to be implemented within this area includes drainage design taking into account the principles of Sustainable Drainage Systems (SuDS) providing attenuation up to the 1 in 100 year annual probability event including an allowance for climate change. It is envisaged that 22 balancing ponds will be provided: 11 of which will be for highway and four for development impermeable area drainage (including the Birmingham Interchange station and associated infrastructure), and five for railway and two for people mover drainage. These balancing ponds are shown on Maps CT-06-105b to CT-06-107-R1, Volume 5, Map Book Water resources.

13.4.4 In addition to the balancing ponds, which mitigate an increase in flood risk due to the potential for increased run off rates and volumes, the design also includes three areas

[150] Department for Communities and Local Government (2012), *National Planning Policy Framework.*

providing replacement floodplain storage. These are required due to encroachment on the Hollywell Brook floodplain by the development in the area of the proposed Birmingham Interchange station, and the area of the new A452 Chester Road alignment which crosses over Hollywell Brook on a bridge. These will be located in the area of the proposed Birmingham Interchange station. Two will be located to the north-east of the Birmingham Interchange station area, with the third being located adjacent to Hollywell Brook where it passes under the A452 Chester Road.

13.4.5 Hollywell Brook will require a permanent realignment in order to ensure that the length of watercourse beneath the proposed Hollywell Brook underbridge in the Birmingham Interchange station area is minimised as far as is reasonable practicable. Hollywell Brook will be realigned for approximately 330m, and the watercourse will take a perpendicular path underneath the route. Where the route passes over the Hollywell Brook the underbridge will incorporate gaps to allow the influx of natural light to the brook situated below the structure. In consultation with the Environment Agency, consideration will be given to provide a naturalised channel form and banks around the underbridge although there may be a need to also incorporate erosion protection at specific points.

13.4.6 The car parks at Birmingham Interchange station will be constructed at ground level, which avoids impacts to groundwater that could have resulted from underground construction. As the car parks are not raised this minimises the loss of floodplain storage.

13.4.7 Measures to ensure the minimisation of any effects on groundwater and GWDTEs during the construction of cuttings and excavations, and permanent groundwater effects due to the presence of cuttings, such as the Diddington and Bickenhill cuttings are included within the draft CoCP (Section 16). Further details of the cuttings and excavations are summarised in Volume 5: Appendix WR-002-024. The following measures will reduce adverse potential permanent effects on groundwater flow, to levels that will not be significant. Measures will be implemented, where appropriate, following detailed pre-construction ground investigations and may include:

- install cut-off structures around excavations;
- ensure cut-off structures are driven to sufficient depths to meet an underlying strata or zone of lower permeability;
- promote groundwater recharge, such as discharging pumped water to recharge trenches around excavations to maintain baseline groundwater and surface water conditions; and
- incorporate passive bypasses within the design, which could comprise a 'blanket' of permeable material, such as gravel, placed below cuttings or around structures allowing groundwater to bypass the foundations of the viaducts and bridges, without a rise in groundwater levels on the upstream side.

13.4.8 The draft CoCP (see Volume 5: Appendix CT-003-000) sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme.

These will provide effective management and control of the impacts during the construction period.

13.4.9 The following measures included in the draft CoCP, will reduce potentially significant adverse effects on water resources and flood risk to levels that will not be significant:

- implementation of all the relevant measures defined in the draft CoCP. This will include method statements for surface water crossings, and realignments, in consultation with the Environment Agency, to ensure any temporary impacts on water quality and flow are acceptable. This will ensure that there will be no significant effect on surface water quality or flows associated with construction;
- implementing, in consultation with the Environment Agency and SMBC, as the Lead Local Flood Authority (LLFA), a surface water and/or groundwater monitoring plan as required, particularly in relation to works which may affect groundwater sensitive areas (draft CoCP, Section 16);
- preparing method statements, in consultation with the Environment Agency, for surface water crossings and realignments such as the Hollywell Brook to ensure that any temporary impacts on water quality, flood risk and ecology are acceptable. These will include details of suitable construction sequencing, channel stabilisation, methods for managing potential pollution events and methods to be used for controlling sediment release (draft CoCP, Section 16);
- preparing site-specific flood risk management plans for those areas at risk of flooding such as for works in the vicinity of the River Blythe (draft CoCP, Section 16);
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect water resource and flood risk during construction (draft CoCP, Section 5); and
- following the measures outlined for the provision of suitable site drainage, for the storage and control of oils and chemicals and to mitigate against accidental spillages (draft CoCP, Section 16).

13.4.10 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

13.4.11 This section describes the significant effects following the implementation of avoidance and mitigation measures.

13.4.12 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-002-024 and FRA in Volume 5: Appendix WR-003-024.

13.4.13 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).

13.4.14 It is considered that projected climate change effects, combined with the effects from the construction of the Proposed Scheme, will not 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

13.4.15 The assessment shows that there will be no significant adverse effects on surface water resources during the construction period.

13.4.16 As no significant effects on surface water features have been identified, no significant effects on abstractions or discharges will arise.

13.4.17 The assessment shows that by adopting the measures and standards defined in the draft CoCP there will be no residual significant adverse effects on surface water during the construction period.

Groundwater

13.4.18 The assessment shows that by adopting the measures and guidance included in the draft CoCP will be no significant adverse effects on groundwater and GWDTEs, during the construction period.

Flood risk

13.4.19 The assessment has identified no significant increase in risks resulting from all sources of flooding during the construction process and therefore no significant adverse effects.

Cumulative effects

13.4.20 There are no committed developments that have been identified which will result in significant cumulative temporary effects.

Permanent effects

Surface water

13.4.21 There are considered to be no significant permanent adverse effects arising during construction that will continue into the operational phase of the Proposed Scheme for surface water.

Groundwater

13.4.22 The assessment has identified no significant permanent adverse effects arising during construction that will continue into the operational phase of the Proposed Scheme for groundwater.

Flood risk

13.4.23 Following the implementation of the avoidance and mitigation measures identified previously, for example balancing ponds and replacement flood storage areas, the assessment has identified no significant permanent adverse effects on flood risk.

13.4.24 The assessment shows there will be no other significant permanent adverse effects on water resources and flood risk.

Cumulative effects

13.4.25 There are no committed developments that have been identified which will result in significant cumulative permanent effects.

Other mitigation measures

13.4.26 No further mitigation measures have been identified for surface water, with the exception of the naturalisation proposed within the Hollywell Brook and the unnamed watercourse at Denbigh Spinney. Naturalisation will include pools, with soft banks and shelves (see Ecology, Section 7). In consultation with the Environment Agency consideration will be given to the WFD objectives described in the RBMP. This may include the use of soft engineering solutions for bank design, the inclusion of natural forms, riffles, pools and marginal planting where reasonably practicable.

13.4.27 No other mitigation measures are not considered necessary for groundwater or flooding.

Summary of likely significant residual effects

13.4.28 Following mitigation, including the application of the measures outlined within the draft CoCP, no significant residual adverse effects to water resources and flood risk have been identified within the assessment.

13.5 Effects arising from operation

Avoidance and mitigation measures

13.5.1 Generic examples of design measures that will mitigate impacts so that there will be no significant adverse 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 and in the operation and maintenance plan for water resources and flood risk included in Volume 5: Appendix WR-001-000.

13.5.2 Specific design measures that mitigate/reduce impacts to non-significant levels in relation to flow including replacement floodplain storage areas have been described within permanent construction effects (see Volume 1, Section 13.4).

13.5.3 Design measures that mitigate/reduce impacts to non-significant levels in relation to water quality and pollution risk include the balancing ponds incorporated within the design of the Proposed Scheme. The balancing ponds are primarily for balancing run-off, but also provide water quality benefits. The design has included the provision for access to balancing ponds, watercourses and structures to allow for future

maintenance during operation. These balancing ponds are shown in Maps CT-06-105b to CT-06-107-R1, Volume 2, CFA24 Map Book.

13.5.4 Run-off from new and modified roads and car parking areas has the potential to contain metals, suspended solids and other contaminants. Drainage outfalls from car parks and highways will include appropriate pollution control. Run-off from modified highways, for example the Stonebridge Island, would be directed through a new balancing pond. The controlled release through balancing ponds allows for settlement of particulate matter with the associated reductions of contaminants and the mitigation of adverse impacts to the Hollywell Brook and the River Blythe. The addition of balancing ponds to existing areas of highway will lead to a small improvement in water quality of the run-off from the modified highway.

13.5.5 Generic examples of management measures during operation and management of the Proposed Scheme that will mitigate impacts so that there will be no significant adverse effects on the quality and flow characteristics of surface water watercourses 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.

13.5.6 Operation and management of the Proposed Scheme are not likely to have a significant adverse effect on flood risk anywhere in the catchments through which it passes. Generic examples of management measures that may mitigate flood risk are described in Volume 1 and Volume 5: Appendix WR-003-024.

Assessment of impacts and effects

13.5.7 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

13.5.8 There are considered to be no further measures necessary to mitigate adverse effects on surface water resources or groundwater resources or flood risk.

Summary of likely significant residual effects

13.5.9 There will be no significant residual adverse effects to water resources and flood risk arising from operation.

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