February 2021

HS2

High Speed Rail (London – West Midlands)

Bromford Tunnel Extension Environmental Impact Assessment Screening Report

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Department for Transport

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Structure of the High Speed Rail (London – West Midlands) Bromford Tunnel Extension Environmental Impact Assessment Screening Report

This document is part of the suite of documents that make up the Bromford Tunnel Extension Environmental Impact Assessment (EIA) Screening Report, as described below:

- Executive Summary. This provides a summary, in non-technical language, of the report findings.
- Screening Report. This introduces the report, provides a description of Bromford Tunnel Extension and an overview of the area in which it is located, and sets out the corresponding EIA screening assessment.
- Appendices. These contain supporting environmental information.
- Map Book. This contains supporting maps, including a plan sufficient to identify the land relating to Bromford Tunnel Extension (Site Location Plan), and plans showing the Bromford Tunnel Extension proposals.

Glossary

2006 Rules	Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006
2013 ES	HS2 Phase One Environmental Statement
2017 Act	High Speed Rail (London West Midlands) Act 2017
ALARP	As Low As Reasonably Practicable
AOD	Above Ordnance Datum
AP	Additional Provision (September 2014)
AP 2	Additional Provision 2 (July 2015)
AP 3	Additional Provision 3 (September 2015)
AP 4	Additional Provision 4 (October 2015)
AP 5	Additional Provision 5 (December 2015)
AQMA	Air Quality Management Area
BCC	Birmingham City Council
BPM	Best Practicable Means
CDM	Construction, Design and Management
CFA	Community Forum Area
CIEEM	Chartered Institute of Ecology and Environmental Management
CoCP	Code of Construction Practice (Annex 1 of the HS2 Phase One Environmental Minimum Requirements)
CoPA	Control of Pollution Act
CSM	Conceptual site model
CSM-RA	Common Safety Method (Risk Assessment)
CSS	Control, command and signalling
dB	Decibel
DCA	Demographic Character Area
DfT	Department for Transport

DMRB	Design Manual for Roads and Bridges
DEFRA	Department for Environment, Food and Rural Affairs
EIA	Environmental impact assessment
EIA Directive	Environmental Impact Assessment (EIA) Directive (2014/15/EU)
EIA Regulations	Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017
EMR	Environmental Minimum Requirements
EPA	Environmental Protection Act
ES	Environmental Statement
EU	European Union
GBN	Ground-borne noise
GBNV	Ground-borne noise and vibration
GHG	Greenhouse gas
ha	Hectares
HGV	Heavy goods vehicle
High Speed Two	HS2
IEEM	Institute of Ecology and Environmental Management
km	Kilometres
kph	Kilometres per hour
LCA	Landscape Character Area
LGS	Local geological sites
LGV	Light goods vehicle
LNR	Local Nature Reserve
LWS	Local Wildlife Site
m	Metres
MA&D	Major accident and natural disaster
mph	Miles per hour
NO_2	Nitrogen dioxide

NPPF	National Planning Policy Framework (2019)
NWBC	North Warwickshire Borough Council
OLE	Overhead line equipment
PM_{10}	Particulate matter
Phase One HIA	HS2 Phase One Health Impact Assessment
Phase One scheme	Scheme as authorised under the 2017 Act
Phase One scheme site	Site of enacted proposals as related to Bromford Tunnel Extension
Proposed Development	Bromford Tunnel Extension
Proposed Development site	Site of the Bromford Tunnel Extension
PRoW	Public Right of Way
RCP	Representative Concentration Pathway
SES 1	Supplementary Environmental Statement (July 2015)
SES 2	Supplementary Environmental Statement 2 (September 2015)
SES 3	Supplementary Environmental Statement 3 (October 2015)
SES 4	Supplementary Environmental Statement 4 (December 2015)
SINC	Site of Importance for Nature Conservation
SMBC	Solihull Metropolitan Borough Council
SMR	Scope and Methodology Report
SNV	Sound, Noise and Vibration
SSSI	Site of Special Scientific Interest
STP	Slurry treatment plant
TBM	Tunnel boring machine
tCO_2e	Tonnes carbon dioxide equivalent
TWAO	Transport and Works Act Order
UKCP18	UK Climate Projections 2018
WPD	Western Power Distribution

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1 Introduction

1.1 Overview

1.1.1 High Speed Two (HS2) is a new high-speed railway proposed by the Government to connect major cities in Britain. HS2 Ltd was formed in January 2009 to deliver the new high-speed rail network between London and the north of England. HS2 Ltd is an executive non-departmental public body sponsored by the Department for Transport (DfT). The High Speed Rail (London – West Midlands) Act 2017 ("the 2017 Act"), received Royal Assent on February 23rd, 2017. The 2017 Act authorises the construction and operation of the Phase One railway between London and the West Midlands and appoints HS2 Ltd as the nominated undertaker for the purposes of exercising powers under the 2017 Act. The Phase One railway comprises the first section of the HS2 rail network, extending approximately 143 miles (230 kilometres (km)) between London and the West Midlands. The target delivery date for Phase One during the passage of the 2017 Act through Parliament was 2026 and this is the basis upon which the accompanying Environmental Statement, as amended was produced. Since enactment, and following publication of the HS2 Chairman's Stocktake[1] and the independent Oakervee Review, the target delivery date for Phase One has been revised to 2029-2033. References within this document to a 2026 delivery date are to ensure that the assessment undertaken here is consistent with the original ES. The amendments to works in the 2017 Act contained within the Proposed Development would be completed by the end of the 2026. In line with recommendations made by the independent Oakervee Review of HS2, published February 11th, 2020, HS2 Ltd has been studying a number of design changes to elements of the scheme authorised by the 2017 Act in order to secure cost savings. One such change is a proposal to extend the Bromford tunnel eastwards by approximately 3.1 km (producing an overall tunnel length of 5.8 km). This would enable a section of the surface railway (which was originally to be constructed in part on viaduct) to be placed underground within the extended tunnel. The new tunnel will require a new intermediate tunnel shaft and portal but will remove the need to construct and carry out a significant number of structures and works. Full details of the new proposal (referred to as the Proposed Development) are set out in Section 2 of this report. The section of the development proposed at the time of enactment of the 2017 Act is referred to as "the Phase One scheme" in this document.

1.1.2 In order to authorise the Proposed Development, in particular the extension of the tunnel, a Transport and Works Act Order ("TWAO") is required in order to

[1] HS2 Ltd Chairman's Stocktake, August 2019, containing advice to the Department for Transport on the deliverability of the HS2 programme from its Chairman

make certain technical amendments to the 2017 Act. Although the 2017 Act incorporates section 4 of the Railways Clauses Act 1863, which provides the power to deviate vertically downwards to replace a surface railway with a railway in tunnel, it is not considered that this power is sufficient in order to confer planning permission on the Proposed Development and to authorise the running of the railway. The reason for this is that the power to deviate downwards would conflict with the terms of certain of the scheduled works specified in Schedule 1 of the 2017 Act that refer to the construction of sections of the railway on viaduct. The purpose of the TWAO therefore is to amend the description of the relevant works to authorise the construction of the railway in the extended tunnel. This report has been prepared in support of the request by HS2 Ltd for an environmental impact assessment (EIA) Screening Decision for the Proposed Development, in advance of a TWAO application. The EIA process, as relevant to the Proposed Development and TWAO, is further described below.

Purpose of this report

1.1.3 The EIA Directive (2014/15/EU) ("the EIA Directive"), provides for the assessment of the environmental impacts of public and private projects. EIA is mandatory for a development listed within Annex 1 of the EIA Directive, which includes lines for long-distance railway traffic. Standing Order 27A of the Standing Orders of the House of Commons relating to private business (environmental assessment) (SO27A) requires that a hybrid Bill, when submitted to Parliament, must be accompanied by an Environmental Statement (ES) and include information referred to in the Town and Country Planning (Environmental Impact Assessment) (England and Wales) Regulations (currently 2017) to assess the environmental effects of the works.

1.1.4 In accordance with SO27A, HS2 Ltd submitted the HS2 Phase One Environmental Statement (ES) ("the 2013 ES"), to accompany the High Speed Rail (London - West Midlands) Bill. Supplementary ESs (SESs) and Additional Provision ESs (AP ESs) were deposited with the hybrid Bill in 2014 and 2015, prior to enactment of the 2017 Act.

1.1.5 Under Rule 7 of the Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006 ("the 2006 Rules"), as amended by The Environmental Impact Assessment (Miscellaneous Amendments Relating to Harbours, Highways and Transport) Regulations 2017 ("the EIA Regulations"), an ES must be submitted if the development proposed to be authorised by the TWAO is an Annex I or Annex II development under the EIA Directive.

1.1.6 The Proposed Development would fall within Annex II, paragraph 13 if it is (a) "Any change or extension of projects listed in Annex I or [Annex II] already authorised, executed or in the process of being executed, which may have significant adverse effects on the environment (change or extension not

included in Annex I)". The Proposed Development is a change to a development listed in Annex I which has been already authorised (specifically a long-distance railway) however a corresponding ES will only be required if it may have significant adverse effects on the environment.

1.1.7 In order to consider likely significant effects on the environment, this EIA screening report compares the relevant aspects of the Phase One scheme with the Proposed Development to determine whether the Proposed Development is likely to have new or different adverse significant effects on the environment by virtue of factors such as its nature, size or location. From this point forward, reference to 'new or different significant effects' within this report concerns adverse effects.

1.1.8 Given the need for a TWAO, this report accompanies a request to the Secretary of State for Transport for an EIA Screening Decision, under Rule 7 of the 2006 Rules, as amended.

1.1.9 In accordance with Rule 7(5) of the 2006 Rules, as amended by the EIA Regulations, this report contains the following:

(a) a plan sufficient to identify the land affected by the works in question;

(b) a description of the proposed works, including in particular—

(i) a description of the physical characteristics of the works and, where relevant, of demolition works; and

(ii) a description of the location of the works, with particular regard to the environmental sensitivity of geographical areas likely to be affected;

(c) a description of aspects of the environment likely to be significantly affected by the works; and

(d) to the extent the information is available, a description of any likely significant effects of the works on the environment resulting from—

(i) the expected residues and emissions and the production of waste, where relevant; and

(ii) the use of natural resources, in particular soil, land, water and biodiversity.

(e) a description of any features of the proposed works or any measures envisaged to avoid or prevent what might otherwise have been significant adverse effects on the environment.

2 Overview of the area and description of the Proposed Development

2.1 Overview of the area

General

2.1.1 The Proposed Development extends from the Attleboro Lane area, Water Orton, at its eastern extent, to Castle Bromwich Business Park, Birmingham, at its western extent, as shown on the Site Location Plan, Figure 2.1, Map Book. The Proposed Development falls within North Warwickshire Borough Council (NWBC) and Birmingham City Council (BCC) administrative areas. The Solihull Metropolitan Borough Council (SMBC) administrative area is located to the south of the Proposed Development.

Settlement, land use and topography

2.1.2 The south eastern area of the Proposed Development is semi-rural in character, comprised of agricultural grazing with residential properties extending from Water Orton parish along Attleboro Lane. Smith's Wood parish within Solihull, to the south, is more densely developed and urban in character. The central and north western areas of the Proposed Development are urban fringe in character, with light industrial, commercial and infrastructure uses through Castle Bromwich and Castle Vale. The industrial and commercial areas make use of lower lying land close to the River Tame and the corridor of main transport infrastructure including the M6 and A452, that follow the valley. The main residential areas are generally on higher ground, away from the valley floor, which has been prone to flooding.

2.1.3 Topographically, the high point of the Proposed Development is located near the B4118 Birmingham Road, at the top of the River Tame valley slope on the south side of Park Hall Wood. This location has a spot height of approximately 106m Above Ordnance Datum (AOD) and, apart from the dramatic drop into the valley floodplain, it also falls away gently to the east.

Key transport infrastructure

2.1.4 To the east of the Proposed Development, the M42 runs north-south and connects with the M6 via an east-west interchange, referred to as the M6-M42 link, which is located south of the Proposed Development. The M6 and A452 run broadly parallel towards the west of the Proposed Development. The B4118

Birmingham Road crosses the M6 and A452 just to the west of Water Orton parish and continues past Park Hall Academy towards Birmingham.

2.1.5 The River Tame valley is a major transport corridor into Birmingham city centre and comprises both rail and road infrastructure. The Birmingham to Derby railway line runs broadly from the east into Birmingham New Street station and similarly the M6 and A452 both use this east-west corridor. Water Orton railway station provides access to rail services to Birmingham in the west and Nuneaton approximately 15km to the east.

Socio-economic profile

2.1.6 To provide a socio-economic context for the area of the Proposed Development, data is presented for the demographic character areas (DCA) of Water Orton, Smith's Wood, Castle Bromwich, Castle Vale and Bromford. A DCA represents a community which, depending on the area, may consist of a local ward, neighbourhood or village(s). Based on the 2011 census, the population of the Smith's Wood DCA is approximately 12,000 people and the population of the Water Orton DCA is approximately 5,000 people. The population for Water Orton reflects the more rural nature of the DCA in comparison to the urbanised Smith's Wood. In total, the population of the Castle Bromwich and Bromford area is approximately 13,000 people; of which Castle Bromwich DCA is approximately 5,000 people, Castle Vale DCA is approximately 3,500 people and Bromford DCA is approximately 4,000 people, which highlights the urban nature of the area.

2.1.7 Based on the 2011 census, the labour market in the Water Orton DCA has an unemployment level of 4.2% of the economically active population, which is lower than the national average of 7%. In contrast, unemployment in the Smith's Wood DCA, to the south, is 14.7%, which is significantly higher than the national level. In 2011, the unemployment rate for the Castle Bromwich DCA was 7%; 17% in the Castle Vale DCA; and 20% in Bromford DCA[2] compared to the average for the West Midlands of 9% and national average of 7%.

Notable community facilities

2.1.8 The village of Water Orton has a range of day-to-day facilities including a small parade of shops, two public houses, several community venues, active sports clubs with indoor and outdoor facilities, two churches and Water Orton Primary School, which has a nursery school and an afterschool club, and which is used by a number of organised community groups during evenings and at weekends.

2.1.9 The suburb of Castle Bromwich is an expanded historic settlement, with Castle Bromwich Hall, St. Mary and St. Margaret Church and the surrounding designated Castle Bromwich conservation area to the west. To the south of

[2] All statistics come from Office for National Statistics (ONS) (2012). 2011 Census. London, ONS.

Castle Bromwich is a youth and community centre that neighbours the Castle Bromwich Junior School. There are several nearby primary schools and Park Hall Academy secondary school to the north of Castle Bromwich, south of the A452.

2.1.10 The Castle Vale residential area, located approximately 9km north-east of Birmingham city centre, is a post-war housing estate that has undergone various regeneration initiatives with the construction of new housing and community facilities. There are several primary schools and the Greenwood Academy (secondary school) within the estate. In addition, the Castle Vale Campus located in the centre of the estate includes a library and a skills centre operated by Birmingham Metropolitan College. The Castle Vale Retail Park to the west of the residential areas provides several superstores, whilst Reed Square in the centre of the estate includes a range of neighbourhood services.

Recreation, leisure and open space

2.1.11 Water Orton has a range of outdoor sports and recreation provision encompassing football, cricket, bowls, tennis and informal recreation and play at the equipped playing fields off Vicarage Lane and the village green off Attleboro Lane. Water Orton Primary School is situated within the village and there is shared community use of school facilities by a number of regular leisure clubs and groups during evenings and at weekends.

2.1.12 There are large areas of open space throughout the Castle Bromwich area, with Lanchester Park to the north east of the main residential area, adjacent to the A452. The gardens of Castle Bromwich Hall provide a visitor attraction with an important heritage value, whilst the Hall provides a hotel with conference, event facilities and a restaurant.

2.1.13 To the north of Castle Bromwich and the M6, Park Hall nature reserve provides a recreational resource with organised visits and volunteering opportunities managed by the Wildlife Trust for Birmingham and the Black Country.

2.1.14 To the south-east of the Castle Vale estate is Farnborough Road Park, a large public open space, which includes Vale Stadium, and the Castle Vale football ground. This park includes several grassed football pitches and a local children's play area.

Policy and planning context

2.1.15 HS2 is being developed on a national basis to meet a national need, however it is referred to in adopted and emerging local planning policy in this area. In seeking to consider the Proposed Development in the local context, the following local policies have been considered and referred to where appropriate to the assessment in relation to environmental topics.

- The Birmingham Development Plan (BDP) (Adopted January 2017).
- The Solihull Local Plan: Shaping a Sustainable Future (Adopted December 2013).
- The Solihull Local Plan Review: Draft Local Plan (November 2016). A supplementary round of consultation on the Draft Submission Version of the Local Plan took place between the 30th October and 14th December 2020, however the final submission version is yet to be submitted to the Planning Inspectorate for independent examination. It is expected that the submission version of the Draft Local Plan will be submitted for approval in 2021
- The North Warwickshire Local Plan (NWLP) (Adopted July 2006).
- The North Warwickshire Local Plan: Core Strategy (Adopted October 2014). Upon adoption of the Core Strategy, all but Core Policies 4, 7 and 9 of the Adopted 2006 Local Plan were 'saved' under Direction from the Secretary of State. These 'saved' policies and the policies of the adopted Core Strategy will be replaced as work progresses on the new Local Plan for North Warwickshire.
- The Draft North Warwickshire Local Plan (November 2017). The draft Local Plan was sent to the Planning Inspectorate for Examination on 27th March 2018. This plan examination remains in progress and additional documents requested by the inspector are under consultation prior to making main modifications to the submitted plan. When adopted, this plan will replace the policies of the 2006 Local Plan and the 2014 Core Strategy.

2.1.16 There are a number of key planning designations in the area, which include conservation areas, listed buildings, scheduled monuments, historic parks and gardens, ancient woodland and other non-designated heritage assets, and are considered within the relevant sections of this report.

2.1.17 Emerging policies are not generally considered within this report, unless a document has been submitted to the Secretary of State for approval. Of the three local authority administrative areas concerned, Solihull Metropolitan Borough Council and North Warwickshire Borough Council have submitted draft policies to the Planning Inspectorate at the current time.

Committed Development

2.1.18 Developments with planning permission or sites allocated in adopted development plans close, and potentially relevant, to the Phase One scheme and the Proposed Development, are presented below in Table 2.1.1. This includes those identified in the 2013 ES, as amended in a series of Supplementary ESs and Additional Provision ESs named in the table. These developments are referred to as committed developments.

Table 2.1.1 Committed developments identified by the 2013 ES, Supplementary ESs and Additional Provision ESs

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
Committed development identified in the 2013 ES						
CFA19/5	Solihull Metropolitan Borough Council 2011/696	Application	Full consent (2011/696) for the development of phase 1 of a new High Street comprising commercial units in use classes A1, A2, A3, A5 and B1/A2 offices with associated access, car parking and landscaping.	Land west of Smith's Wood Primary School and south of Kingfisher Drive, B36 0S	Solihull in Partnership Ltd	
CFA19/10	North Warwickshire Borough Council PAP/2010/0009	Application	Erection of 29 sheltered apartments plus communal day room, warden's office and guest bedroom, with private amenity space and parking areas.	Land adjacent the Dog Inn Marsh Lane Water Orton B46 1NW	Bluemark Development Ltd & Punch Taverns (ptl) Ltd.	
CFA19/11	North Warwickshire Borough Council PAP/2012/0568	Application	Erection of two polytunnels for breeding of fish and growing plants for sale	Hillcrest Birmingham Road Water Orton Warwickshire B46 1TG	R H Farrier Services	
CFA25/1	Birmingham City Council 2012/06220/PA	Application	Erection of employment building for B8 (storage and distribution) associated access, parking, drainage and landscaping.	Plot 5, Prologis Park, Midpoint, Former Minworth Sewage Works, Minworth, Sutton Coldfield	Prologis UK	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
CFA25/2	Birmingham City Council 2012/00236 /PA	Application (Permission will be extinguished by the Phase One scheme)	Improvements to the Castle Bromwich Incinerator Bottom Ash Processing Facility including construction of a concrete ground slab, concrete drainage lagoon and sumps, relocated glass recycling bays and improved internal access road.	Incinerator Bottom Ash Processing Facility Tameside Drive Castle Bromwich, Birmingham , B35 7AG	Veolia Environmental Services (Birmingham) Ltd	
Committed development identified in Additional Provision 1 Environmental Statement (September 2014)						
No relevant committed developments identified.						
Committed development identified in Supplementary Environmental Statement 1 and Additional Provision 2 Environmental Statement (July 2015)						
CFA19/14	North Warwickshire Borough Council PAP/2013/0 211	Application	Removal of existing Use Class B2 and office buildings, storage and car parking. Erection of new industrial building with associated offices partly over existing lake formed due to gravel extraction. Landscaping including car parking and goods delivery area.	Mallard Lodge Site, Marsh Lane, Water Orton, Warwickshire, B46 1NS	Flexdart Ltd	Formerly listed as CFA19/P/6 in 2013 ES, as amended, (Volume 5: Appendix CT-004-000), as a proposed development.
CFA25/5	Birmingham City Council 2013/08948 /PA	Application	Creation of internal road to serve existing development plots, including	Prologis Park, Midpoint, Minworth	Prologis Developments Ltd	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
			realignment of existing fencing.	Sutton Coldfield		
CFA25/6	Solihull Metropolitan Borough Council 2014/959	Application	Erection of five three-bedroom houses and associated access and car parking.	Land at Lanchester Way, Castle Bromwich, B36	Mr George Oxford	
CFA25/7	Birmingham City Council 2014/02484/PA	Application	Erection of two detached industrial/distribution units including access and servicing arrangements, car parking, landscaping and associated works.	Park Lane, Minworth	Bericote Properties Limited	
CFA25/9	Birmingham City Council 2014/09509/PA	Application	Demolition of existing gate house and reinstatement of yard, erection of new gate house and access barriers, conversion of dock levellers to level access doors, alterations to eastern elevation to include new fire doors, alterations to the yard to accommodate change in gradients for the level access doors, new vehicular and pedestrian access from estate road, removal of retaining walls	DC4 Prologis Park Midpoint, Midpoint Way, Sutton Coldfield, Birmingham, B76 9EH	Prologis UK Ltd	Associated development CFA 25/5 2013/08948/PA identified above and in the SES and AP 2 ES (Volume 5: Appendix CT-004-000).

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
			and provision of new retaining walls, erection of canopies to level access doors and associated access, landscape and drainage works.			
Committed development identified in Supplementary Environmental Statement 2 and Additional Provision 3 Environmental Statement (Sept. 2015)						
No relevant committed developments identified.						
Committed development identified in Supplementary Environmental Statement 3 and Additional Provision 4 Environmental Statement (Oct. 2015)						
CFA25/9	Birmingham City Council 2015/00285 /PA	Application	Erection of an extension of approximately 15,237m2 to Unit DC4 for storage and distribution and ancillary office use and a gatehouse with associated service yard, access, parking, drainage and landscaping infrastructure and works.	Plots 4 and 6 Prologis Park, Midpoint Way, Sutton Coldfield, Birmingham , B76 9EH	Prologis UK Ltd	Formally listed as CFA23/P/5 in SES and AP 2 ES (Volume 5: Appendix CT-004-000), as a proposed developme nt
CFA25/10	Birmingham City Council 2015/00275 /PA	Application	Erection of 1,000m2 detached warehouse.	Jaguar Landrover, Ashold Farm Road, Birmingham , B24 9PB	Mr Mike O'Shea	Formally listed as CFA23/P/6 in SES1 and AP 2 ES (Volume 5: Appendix CT-004-000), as a proposed developme nt
Supplementary Environmental Statement 4 and Additional Provision 5 Environmental Statement (Dec. 2015)						
No relevant committed developments identified.						

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
Bromford Tunnel Extension Screening – Additional Committed Developments (permissions and allocations subsequent to SESs/AP ESs and prior to 31 July 2020)						
CFA25. reference 1 (r1)	Birmingham City Council Birmingham Developme nt Plan Policy TP32	Allocation	The regeneration and renewal of existing housing areas will continue to be promoted to ensure that high quality accommodatio n and environments are provided in line with the principles of sustainable neighbourhood s. The initial priorities will be (amongst others) the Bromford Estate.	The Bromford Estate Riddfield Road B36 8PS	N/A	
CFA25.r21	Birmingham City Council 2012/03884 /PA	Approved Application	Change of use from private recording studio associated with the existing residential dwelling to commercial recording studio (mixed use class B1/C3).	20 Cadbury Drive Castle Vale Birmingham B35 7EW	Mr Philip Croft	
CFA19.r8	North Warwickshir e Borough Council PAP/2014/0 287	Approved Application	Erection of two new two bedroom bungalows to rear with independent vehicular access	94 Birmingh am Road Water Orton Warks B46 1TG	Mr Mark Riase	
CFA25.r2	Birmingham City Council	Approved Application	Demolition of existing buildings and	Fort Industrial Park,	Rolton Kilbride	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
	2015/09679 /PA		erection of a renewable energy centre (gasification plant) and new industrial/ware house buildings with ancillary plant/buildings/ chimney stack together with associated works	Dunlop Way, Castle Bromwich, Birmingham , B35 7RB		
CFA25.r3	Birmingham City Council 2015/10119 /PA	Approved Application	Erection of two residential dwelling	55 Water Orton Lane Minworth Sutton Coldfield Birmingham B76 9BD	N/A	
CFA25.r4	Birmingham City Council 2015/02540 /PA	Approved Application	Erection of new school building with associated sports hall, external play areas, landscaping and parking as a replacement for the existing Greenwood Academy	Land off Farnboroug h Road Castle Vale Birmingham B35 7NL	N/A	
CFA19.r1	Solihull MBC PL/2015/52 603/PPFL	Approved Application	Demolish existing industrial buildings and erect 24 No. units comprising three dwellings (three x two bedroom dwellings) and 21 one-bedroom apartments with parking, amenity space and associated works.	Windward Way Industrial Estate Trent Drive Smiths Wood Solihull B36 0UJ	Mr Andrew Watson	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
CFA19.r2	Solihull MBC PL/2015/51559/COU	Approved Application	Change of use from two flats back to one single dwelling.	30 Sunbeam Close Smiths Wood Solihull B36 9JR	Mr Kip Paul	
CFA19.r5	North Warwickshire Borough Council PAP/2015/0304	Approved Outline Application	Erection of single storey dwelling with access from Vesey Close (with details of access and layout)	9 Vicarage Lane Water Orton B46 1RX	Mr Lee Harriott	Related to committed development CFA19.r6
CFA19.r6	PAP/2016/0459	Approved Reserved Matters	Approval of reserved matters for 1 (a) appearance, (b) landscaping (c) scale. Drop kerb details and drainage	9 Vicarage Lane Water Orton B46 1RX	Mr J Kinghorn	Related to committed development CFA19.r6
CFA25.r5	Birmingham City Council 2016/02972/PA	Approved Application	Creation of new external sports pitch with associated features including 3G Artificial Grass Pitch (AGP), erection of perimeter ball-stop fencing, installation of hardstanding areas around the AGP for pedestrians, maintenance and emergency access, refurbishment of artificial floodlighting system and installation of outdoor store for maintenance equipment.	Castle Vale Stadium Farnborough Road Castle Vale Birmingham B35 7NH	Laura Hawkins	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
CFA25.r6	Solihull MBC PL/2016/01304/PPFL	Approved Application	Erect a four-bedroom detached house	Land at Reliant Close Castle Bromwich Solihull, B36 9NG	Mr George Oxford	
CFA25.r7	Solihull MBC PL/2016/00467/PPFL	Approved Application	Change of use from guest house (use class C1) to residential care home (use class C2) for up to eight residents.	38 Chester Road Solihull B36 9BX	N/A	
CFA19.r3	North Warwickshire Borough Council PAP/2016/0027	Approved Application	Demolition of existing commercial units and garaging and erection of two bungalows	Rear of 50 Birmingham Road, Water Orton, B461TH	N/A	
CFA19.r4	North Warwickshire Borough Council PAP/2016/0709	Approved Application	Relocation of Rugby club, new clubhouse with clubroom and changing facilities, playing pitches for Senior and Junior Rugby with flood lighting to one pitch and associated parking for cars and coaches with access road	Land east of 68 Vicarage Lane, Water Orton	Mr Julian Harrandence	
CFA25.r8	Birmingham City Council 2017/07192/PA	Approved Application	Erection of two dwellings with associated access and parking	Land adjacent 59 Water Orton Lane Sutton Coldfield Birmingham B76 9BD	Miss C McKenna	
CFA25.r9	Birmingham City Council 2017/06759/PA	Approved Application	Erection of six semi-detached dwellings with associated	81-89 Water Orton Lane Land between	N/A	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
			access, parking, landscaping and garages	Sutton Coldfield Birmingham B76 9BD		
CFA25.r10	Birmingham City Council 2017/07718 /PA	Approved Application	Installation of an A1/ A3 pod with associated outdoor seating areas, drive through facility, landscaping and associated works	Castle Vale Retail Park Chester Road Tyburn Birmingham B35 6HB	Harbour Holdings S.A.R.L	
CFA25.r11	Birmingham City Council 2017/03519 /PA	Approved Application	Erection of 11 dwellings, access and parking	Land next to 31 Park Lane Minworth Sutton Coldfield Birmingham B76 9BL	N/A	
CFA25.r12	Birmingham City Council 2017/05607 /PA	Approved Application	Change of use from social club (Use Class D2) to mixed community centre (Use Class D1) and place of worship (Use Class D1) with alterations to front elevation and roof.	The Firs Members Club Shawsdale Road Castle Bromwich Birmingham B36 8NG	Mr Hussain Tassadaq, Hodge Hill Community Centre	
CFA25.r13	Birmingham City Council 2017/03380 /PA	Approved Outline Application	Outline application for erection of 29 dwellings with access, appearance, layout and scale to be determined and landscaping to be reserved for future consideration	Collingbourne Avenue (Former Comet PH) Hodge Hill Birmingham B36 8PE	Mr David Rahal	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
CFA19.r7	Solihull Metropolitan Borough Council PL/2017/03389/COU	Approved Application	Change of use from Class B1 office accommodation to Class D1 education use.	Jensen House Auckland Drive Smiths Wood Solihull B36 0DD	Mr Anthony Watson, SMBC	
CFA25.r14	Birmingham City Council 2018/06785/PA	Approved Application	Erection of 28 residential dwellings alongside associated highway works and landscaping	Land at junction of Bromford Drive/Chipperfield Road Birmingham B36	Mr Ron Williams, Birmingham City Council Housing & Regeneration Team	
CFA19.r9	North Warwickshire Borough Council PAP/2018/0623	Approved Application	Change of use of garden land to residential and erection of a temporary garden building for storage	25 Mytton Road Water Orton B46 1TN	Mrs A Roath	
CFA25.r15	Birmingham City Council 2018/04837/PA	Approved Application	Erection of two dwellings with associated access, parking and garage	Land adjoining Kimal Old Kingsbury Road Minworth Sutton Coldfield Birmingham B76 9AE	N/A	
CFA25.r16	Birmingham City Council 2018/10301/PA	Approved Application	Erection of five dwellings with associated car parking & landscaping	Land on Longley Avenue Sutton Coldfield Birmingham B76 9RA	N/A	
CFA25.r17	Birmingham City Council 2018/03568/PA	Approved Application	Erection of 20 dwellings with associated landscaping and external works	Land at former Comet PH Collingbourne Avenue Hodge Hill Birmingham B36 8PE	Mr Smith, AJS Properties Ltd	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
CFA25.r18	Birmingham City Council 2018/02828 /PA	Approved Application	Erection of 124 dwelling with associated landscaping and car parking	Former Greenwood Academy Farnborough Road Castle Vale Birmingham B35 7NL	Gill Beveridge, Birmingham Municipal Housing Trust	
CFA25.r19	Birmingham City Council 2019/05286 /PA	Approved Application	Erection of 25 dwellings and associated highway works and landscaping	Land adjacent Bromford Drive and Chipperfield Road Birmingham B36 8BU	Mr Ron Williams Birmingham City Council Housing and Regeneration Team	Likely Associated with the noted BDP Allocation, however this is not explicitly stated in the application planning statement/ DAS. See associated application 2018/06785 /PA
CFA25.r20	Birmingham City Council 2020/00687 /PA	Approved Application	Erection of new dwelling, erection of front canopy to existing dwelling and construction of footway crossing	43 Rye Grass Walk Birmingham B35 7LL	N/A	
CFA25.r22	Birmingham City Council 2020/05259 /PA	Approved Application	Change of use from dwelling house (Use Class C3) to children's care home (Use Class C2) and associated external alterations	316 Coleshill Road Hodge Hill Birmingham B36 8BG	N/A	
CFA25.r23	Birmingham City Council	Approved Application	Construction of flood defences to include	Land south of the River Tame,	Mrs Victoria Edge	

Reference	LPA & LPA Reference	Application /Allocation	Description	Site Address	Applicant	Comment
	2019/02210 /PA		embankments, flood walls etc along the River Tame corridor between Hurricane Park and Castle Bromwich Business Park	between Hurricane Park and Castle Bromwich Business Park Castle Vale Birmingham		

2.2 Need for the Proposed Development and history of the Proposed Development

Need for the Proposed Development

2.2.1 The Proposed Development would provide environmental, social and cost benefits over the Phase One scheme. These benefits would include:

- reduction in ecological impact through avoidance of removal of 0.7ha of ancient woodland and 2.7ha of broadleaved semi-natural woodland, along with reduced impact to other habitats associated with Park Hall nature reserve, a Site of Importance for Nature Conservation (SINC) and the River Tame SLINC;
- avoiding the demolition requirement for the following commercial properties:
  - three-storey industrial recycling facility, Tameside Drive, Castle Bromwich Business Park;
  - two single-storey brick industrial premises, Units 7, 8, 9, 10, 11, 12, 13, 14, 14a Orton Way, Hayward Industrial Estate; and
  - a single-storey brick industrial premises, Units 15, 16, 17, 18, 19, 20 Orton Way, Hayward Industrial Estate.
- avoiding the realignment of approximately 600m of the River Tame and its tributaries the Plants Brook and the Dunlop Channel;
- reducing utility diversions;
- reducing visual impact from new transport infrastructure within the River Tame Flood Plain, including the removal of 780m long and 10m high River Tame viaduct within the Phase One scheme; and
- reducing the construction period in the Washwood Heath to Curzon Street area (CFA26).

The Phase One scheme

2.2.2 The alignment of the Phase One scheme travels west from the intersection between the North Chord and Birmingham Spur adjacent to Water Orton,

through the Park Hall nature reserve and on to the Hayward Industrial Estate where the route enters the Bromford tunnel via the Bromford tunnel east portal.

2.2.3 The route of the Phase One scheme in this area heads generally west, towards Birmingham city centre. The route is in deep cutting (known as Water Orton cutting), as it passes from the adjacent Coleshill Junction area (CFA19) into the Castle Bromwich and Bromford area (CFA26).

2.2.4 The route passes under the B4118 Birmingham Road and west from the Park Hall Wood embankment, onto the River Tame viaduct, across the diverted River Tame and then onto the raised Langley Hill embankment, adjacent to and parallel with the existing Birmingham and Derby railway line. The route then passes over Plants Brook and the Dunlop Channel tributaries of the River Tame, before entering the eastern edge of the Castle Bromwich Business Park. From this point the route descends into cutting (known as Castle Bromwich retained cutting), heading towards the twin bore Bromford tunnel[3].

2.2.5 The area of land required for the construction of the Phase One scheme includes most of Park Hall nature reserve and requires the removal of areas of both mature and ancient woodland to allow for the Water Orton cutting and permanent diversion of Western Power low voltage (11kV) underground electricity cables under the route. The construction and operation of the Phase One scheme also includes the reconfiguration of Castle Bromwich Business Park and Hayward Industrial Estate, with the land for the construction of the eastern tunnel portal being required permanently during the operation of HS2.

2.2.6 Within the Phase One scheme, the Bromford tunnel emerges via the eastern tunnel portal, west of the River Tame, within the Washwood Heath area (CFA26), in the location of the Washwood Heath rolling stock maintenance depot, which will also contain the network control centre. From there the line carries on to Curzon Street Station, Birmingham.

History of the Proposed Development

2.2.7 Following the Phase One scheme gaining royal assent in 2017, a process of value engineering was undertaken in order to seek to identify and implement benefits through design development over and above the design outlined within the 2013 ES, as amended. At a Value Engineering Workshop undertaken on October 17th, 2017, the proposal to extend the tunnel was assessed and found to provide benefits in terms of whole life cost, ease of construction, and to the environment and the local community and economy. Further design

[3] There will be two adjacent tunnels: one tunnel bore will run a track west towards Curzon Street station and the second bore will run the other track east towards Water Orton.

development and refinement therefore continued to become the Proposed Development.

2.2.8 The Proposed Development would double the length of the Bromford tunnel within the Phase One scheme, meaning that instead of the railway being constructed partly on viaduct it would be constructed in tunnel. The Bromford tunnel east portal, as included within the Phase One scheme, would be replaced by Bromford tunnel intermediate shaft. The opportunities identified that the Proposed Development would bring are as follows:

- avoiding disruption to the Hayward Industrial Estate and reducing impact to the Castle Bromwich Business Park;
- removing the requirement to realign approximately 600m of the River Tame;
- reducing carbon emissions due to the reduced overall extent of built infrastructure;
- relocating the portal out of the floodplain and placing the railway in tunnel beneath it and reducing climate change effects due to reduced flood risk;
- reducing environmental impacts to the Park Hall nature reserve;
- reducing the area of best and most versatile land affected, together with reducing effects on both soil resources and agricultural land holdings;
- removing some landscape and visual impacts and impacts on a number of heritage assets by placing railway infrastructure within extended tunnel rather than on the surface;
- reducing operational airborne noise for a number of properties by placing exposed track in extended tunnel, in the vicinity of those properties;
- removing the risk of structural impact to the existing M6 Bromford Viaduct that would have been posed by the construction of the Phase One scheme; and
- reducing the quantity of utilities works.

2.3 Description of the Proposed Development

2.3.1 The Bromford tunnel within the Phase One scheme is approximately 2.9km in length commencing at Castle Bromwich Business Park in the east and extending to the Drew's Lane Industrial Estate to the west (see SES 3 and AP 4 Environmental Statement, Volume 2 Community Area Forum Map Book, CFA 25 Castle Bromwich and Bromford, maps CT06-05-136, A7 to CT-06-138a, A7).

2.3.2 In the Proposed Development the tunnel would be extended to 5.8km in length and would run from the shortened Water Orton cutting (see Map Book: Figure 2.3 (Sheet 2), F4) to the Drew's Lane Industrial Estate (see Map Book: Figure 2.3 (Sheet 1), A4).

2.3.3 As a consequence of the tunnel extension the following features of the Phase One scheme would no longer be required (see SES 3 and AP 4 ES, Volume 2 Community Area Forum Map Book, CFA 25 Castle Bromwich and Bromford):

- the Water Orton Road overbridge and retaining walls (see Map CT-06-135b, F6);
- the Park Hall Wood embankment (see Map CT-06-135b, D6);
- balancing pond, to receive railway drainage from the western end of the Water Orton cutting, and associated access tracks adjacent to the Park Hall Wood embankment (see Map CT-06-135b, E6 to D5);
- two sections of the diversion of an existing fuel pipeline through Park Hall nature reserve (see Map CT-06-135b, J9 to F5);
- the River Tame viaduct, for the route to cross the River Tame at Park Hall nature reserve (see maps CT-06-135b, D6 to CT-06-136, H6);
- realignment of the River Tame channel through Park Hall nature reserve, with new channel connections for Plants Brook and the Dunlop Channel (see Map CT-06-136, I6 to D8);
- an area of woodland habitat creation to the north of the B4118 Water Orton Road (see Map CT-06-135b, F5), although areas of habitat creation will still be provided with the Proposed Development;
- the Park Hall retained fill and Langley Hill embankment (see Map CT-06-136, H6 to E6);
- the Castle Bromwich retained cut (see Map CT-06-136, E6 to B7);
- three balancing ponds and associated access tracks with landscape planting around the balancing pond near to Farnborough Road Park (see Map CT-06-136, I6 to D7);
- the permanent diversion of two sewers, underground Western Power low voltage electricity cables, and National Grid overhead power lines over the route and associated pylons within the extents of the eastern end of Park Hall nature reserve and Castle Bromwich Business Park (see Map CT-06-135b, F6); and
- the permanent diversion of National Grid gas distribution main at Castle Bromwich Business Park (see Map CT-06-135b, F6).

2.3.4 In order to accommodate the tunnel extension, the following new, reconfigured or relocated features will be required:

- an electrical substation 55m by 116m with equipment to a height of up to 7m, with two areas of associated landscape planting to the north of the substation, would be located to the west of the existing Attleboro Lane (see Map Book: Figure 2.3 (Sheet 1), H5). Within the Phase One scheme, the electrical substation is located within the Castle Bromwich Business Park (see Map CT-06-136, D7). The powers to construct this electrical substation would not be sought under this TWAO application;

- a balancing pond, with associated access track adjacent to Water Orton cutting, with landscape planting adjacent to the north of the access track and adjacent to Attleboro Lane (see Map Book: Figure 2.3 (Sheet 2) G5 to G6);
- the Water Orton cutting, approximately 500m in length and up to 13m deep, from Attleboro Lane overbridge to the Bromford tunnel east portal (see Map Book: Figure 2.3 (Sheet 2), H5 to F4). The Water Orton cutting would be shortened by approximately 600m from its western end;
- the Attleboro Lane overbridge would remain unaltered from the Phase One scheme;
- the Bromford tunnel east portal (see Map Book: Figure 2.3 (Sheet 2), F4), would consist of a retained portal box structure approximately 82m in length, 16m deep and 33m wide. At ground level there would be an associated two storey tunnel portal building measuring approximately 20m wide, 75m in length and up to 8.75m high and an auto-transformer station and a compound area measuring 340m by 150m. The compound area would be accessed by a new access road from Attleboro Lane and there would be an area of landscape planting to the north-west of the portal; and
- the Bromford tunnel intermediate shaft would be located within the Castle Bromwich Business Park (see Map Book: Figure 2.3 (Sheet 1), B4 to A4). The Bromford tunnel intermediate shaft would be 22m in diameter and 48m deep. The shaft would be located centrally between the two tunnel bores, with cross-connections into the bored tunnels at track level. At ground level there would be a two storey headhouse building 65m by 40m and up to 11m high, and an associated compound area measuring 160m by 95m.

2.3.5 The extended Bromford tunnel would remain as twin-bore and would pass beneath the B4118 Birmingham Road and the Park Hall nature reserve, and then join the Phase One scheme alignment of the Bromford tunnel. After joining the Phase One scheme alignment the tunnel would pass under the A452 Chester Road, the River Tame, the M6, and Bromford Drive.

2.3.6 Once a tunnel exceeds 3km in length an intermediate shaft is required to facilitate the safe flow of air within the tunnel. The proposed Bromford tunnel extension would mean that the tunnel will be 5.8km and the required intermediate shaft would be located within the Castle Bromwich Business Park.

2.3.7 The Bromford tunnel intermediate shaft would form the western extent of the Proposed Development. From this point, the extended tunnel would then continue towards Birmingham city centre and emerge from the Bromford tunnel western portal, located within the Drew's Lane Industrial Estate. The Proposed Development would not require any changes to the Phase One scheme between the Bromford tunnel intermediate shaft and Birmingham city centre.

2.4 Consultation and engagement

2.4.1 Engagement took place with all three local authorities affected by the Proposed Development, during August 2020. This included a joint briefing to officers of Warwickshire County Council (WCC), North Warwickshire Borough Council (NWBC) and Birmingham City Council (BCC). The briefing included an introduction to the Proposed Development and delivery programme. Subsequently, letters regarding the Proposed Development have been issued to the CEOs of the three affected local authorities, Members of Parliament, local councillors, Water Orton Parish Council, local authority officers and statutory bodies (including Network Rail and the Environment Agency). Letters have also been issued to residential properties, businesses and landowners local to the Proposed Development. In addition, briefings and meetings have been held with the Member of Parliament for North Warwickshire and Bedworth, local authority councillors and parish councillors, along with the North Warwickshire Special Management Zone (SMZ) Group, during Autumn 2020.

2.4.2 Engagement and consultation activities have been supported by a dedicated webpage on HS2's local community website which explains the Proposed Development, including maps and a construction programme, whilst introducing associated statutory processes and consultation arrangements. The webpage also provides a link to both an online survey for completion, the HS2 Phase One Act and guidance relating to the TWAO process.

2.5 Construction

2.5.1 This section firstly sets out the strategy for construction of the Proposed Development and then describes any material changes from those envisaged for construction of the Phase One scheme.

2.5.2 Details on the construction strategy include:

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

2.5.3 The assessment presented in this screening report is based on the construction arrangements as described in this section.

2.5.4 In addition to the land that would be required permanently by the Proposed Development (see Section 2.3), land would be required on a temporary basis for construction. Key temporary construction features are illustrated on Map Book: Figure 2.2 (Sheets 1 and 2). Following construction works, land required

temporarily would be restored, which would include being returned to its pre-construction use wherever appropriate.

2.5.5 A guide to standard construction techniques is provided in Volume 1, Section 6 of the 2013 ES, as amended[4].

Overview of the construction process

2.5.6 General information about building and preparing the railway for operation can be found in the main HS2 Phase One environmental statement (2013), Volume 2 Community Forum Area reports for the Castle Bromwich and Bromford (CFA 25)[5], and Washwood Heath to Curzon Street (CFA 26)[6] and Community Forum Area report for HS2 SES and AP 2 for CFA 25[7] and Community Forum Area report for HS2 SES 3 and AP 4 for CFA 25[8]. More detail can be found in the HS2 Environmental Minimum Requirements, Annex 1: Code of Construction Practice (CoCP)[9].

Engineering works

2.5.7 Construction of this section of the railway would require engineering works along the length of the section, and within land adjacent to the route. This would comprise two broad types of engineering work:

- civil engineering works, including earthworks, drainage and the bored tunnel; and
- railway systems works, such as laying slabs and tracks, and installing power supply, overhead line equipment and communications features.

General overview of construction compounds

2.5.8 The construction of both the Phase One scheme and the Proposed Development would be managed from construction compounds. The compounds act as the main interface between the construction work sites and the public highway, as well as performing other functions as described below. Compounds are either

[4] Available at: https://www.gov.uk/government/collections/hs2-phase-one-environmental-statement-documents
[5] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/398104/Vol_2_CFA_25_Castle_Bromwich_and_Bromford.pdf
[6] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/398106/Volume_2_CFA26_Washwood_Heath_to_Curzon_Street.pdf
[7] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/442229/SES_and_AP2_ES_Volume_2_CFA25.pdf
[8] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/466751/SES3_and_AP4_ES_Volume_2_CFA_25_Castle_Bromwich_and_Bromford.pdf
[9] Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/593592/Code_of_Construction_Practice.pdf

main compounds or satellite compounds, which are generally smaller. Some compounds are used for civil engineering works and others for railway systems installation works, and in some cases for both.

2.5.9 Main compounds may be used to undertake construction work, but they are used for core project management staff (i.e. engineering, planning and construction delivery), and commercial and administrative staff, and also the management of satellite compounds. Satellite compounds are used as the base to manage specific works along a section of the route. They 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. 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.

2.5.10 Six construction compounds that were originally required to construct the Phase One scheme are no longer required to construct the Proposed Development. The construction compounds which are no longer required include:

- Bromford tunnel east portal (east) main compound;
- Dunlop carrier channel culvert satellite compound;
- Plants Brook underbridge satellite compound;
- River Tame viaduct satellite compound;
- Castle Bromwich auto-transformer satellite compound; and
- Bromford tunnel east portal building satellite compound.

2.5.11 The construction compounds that are still required are:

- Bromford tunnel east portal main compound (a new compound for the Proposed Development, further details are provided below);
- B4118 Water Orton Road overbridge satellite compound (part of Bromford tunnel east portal main compound for the Proposed Development); and,
- Bromford tunnel east portal (west) satellite compound (becomes the Bromford tunnel intermediate shaft satellite compound for the Proposed Development).

2.5.12 The civil engineering and railway systems works associated with the construction of the Proposed Development would be undertaken from the Bromford tunnel east portal main compound and Bromford tunnel intermediate shaft satellite compound. The Bromford tunnel intermediate shaft satellite compound would be supported by the Curzon Street main compound for rail systems works. The assumed durations for works activities managed by the Curzon Street main compound would remain unchanged from the Phase One scheme.

2.5.13 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 of the 2013 ES, as amended, and the CoCP, Section 5.

Construction traffic routes

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

2.5.15 The main access and egress for heavy goods vehicles associated with the tunnel works and other HS2 Phase One vehicles accessing the site from the east, will be taken from the eastbound hard shoulder of the M6-M42 link road. This access will be restricted to construction related large goods vehicles / heavy goods vehicles only.

2.5.16 Movements between the construction compounds and the work sites is on designated haul roads within the construction site boundary, often along the line of the new railway or running parallel to it.

2.5.17 The information below describes the Proposed Development works that would be undertaken from firstly the civil engineering compounds and then the railway installation compounds.

2.5.18 An outline construction programme is provided in Figure 2.5.

Figure 2.5 Outline Construction Programme

Bromford Tunnel Extension	2020 Quarters				2021 Quarters				2022 Quarters				2023 Quarters				2024 Quarters				2025 Quarters				2026 Quarters			
Construction activity	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Civil Engineering Works																												
Bromford tunnel east portal main compound																												
Balancing pond																												
Water Orton cutting																												
East portal and building construction																												
Bromford tunnel boring																												
Utility monitoring above tunnel																												
Tunnel first stage concrete																												
Mined cross passages																												
East portal building, central shaft construction																												
Portal building and shaft fit out																												
Bromford tunnel east portal auto-transformer station slab base and infrastructure																												
Bromford tunnel intermediate shaft main compound																												
Diaphragm walling																												
Shaft excavation																												
Internal civils works																												
MEP fit out																												
Mined tunnel cross-connections																												
Bromford tunnel east portal (railway systems) main compound																												
Bromford Tunnel east tunnel portal and headhouse fit-out																												
Bromford tunnel east portal auto-transformer station																												
Tunnel Systems, Power, Communications, CCS and OLE																												

Curzon Street main compound

2.5.19 This compound is also not located within the boundary of the Proposed Development and no works will be directly undertaken from it, but it would manage or coordinate works undertaken from the Bromford tunnel east portal (railway systems) satellite compound during railway systems works. See Volume 2, CFA 26 of the 2013 ES, as amended for more information regarding this compound.

Bromford tunnel east portal main compound

2.5.20 This compound (see Map Book: Figure 2.2 (Sheet 1), G5 to D3) would be in a similar location to the B4118 Water Orton Road overbridge satellite compound within the Phase One scheme. It would be used for civil engineering and railway systems works for a total period of six years and three months and it would manage all of the works associated with the Proposed Development (with the exception of the construction of the Bromford tunnel intermediate shaft, which would be undertaken from the Bromford tunnel intermediate shaft satellite compound). The compound would:

- be operational for approximately five years for civil engineering works, starting in 2020;
- continue to be used as Bromford tunnel east portal (railway systems) satellite compound to facilitate the railway system construction period for two years and nine months, starting in 2024. Commissioning will be undertaken after these dates and prior to the railway opening;
- support approximately 300 workers each day throughout much of the civil engineering works period; the construction compound will also support approximately 20 workers each day throughout much of the rail systems installations works period, increasing to a maximum of approximately 45 workers during the peak period of activity;
- would not provide overnight worker accommodation facilities; and
- be managed from Curzon Street main compound during rail systems works (see Volume 2, CFA 26 of the 2013 ES, as amended).

2.5.21 During civil engineering works, construction traffic would initially access the compound from the B4118 Birmingham Road for a period of approximately one year, and then via a haul road which would link directly to Phase One scheme construction sites within the wider geographical area and would directly connect to the M6-M42 link road. This haul road would be used for the delivery of tunnel segments and removal of material away from the Proposed Development. There would be an access for cars and light goods vehicles (LGVs) off the B4118 Birmingham Road, which would be likely become the main access during rail systems works.

2.5.22 A programme for the key works associated with this compound is shown in Figure 2.5. Works in this section of the Proposed Development would be carried out in the following broad phases:

- site clearance and enabling works;
- construction of the balancing pond and associated access roads;
- cutting and earthworks, including stockpile storage, and drainage;
- construction of the eastern tunnel portal;
- construction of Bromford tunnel east portal headhouse, plant house and associated access roads;
- construction of the Bromford tunnel, during which time the compound would house a slurry treatment plant and material storage areas;
- monitoring of existing underground utilities during tunnelling operations;
- construction of auto-transformer slab base and infrastructure;
- Bromford tunnel preparation and finishing works;
- fit-out of the Bromford Tunnel east tunnel portal and headhouse;
- installation of tunnel systems, power, communications, and Control, Command and Signalling (CCS) and Overhead Line Equipment (OLE); and
- reinstatement, landscaping and planting.

2.5.23 No demolitions would be required.

2.5.24 No diversions of any roads would be required beyond those required by the Phase One scheme.

2.5.25 No alternative routes for any public rights of way would be required. However, a temporary HS2 access track has been constructed within Park Hall nature reserve as part of the Phase One scheme and this would continue to provide limited access into Park Hall nature reserve during construction. There are a number of utilities along the tunnel extension that would require monitoring instrumentation to be in use throughout the duration of tunnelling operations. The instrumentation would be installed from above ground at various locations within Park Hall nature reserve and access to install and check the instrumentation would be from the haul road.

2.5.26 The construction of the tunnel would commence from the Bromford tunnel east portal which would be directly east of Water Orton cutting. The shortened Proposed Development Water Orton cutting would be expected to generate approximately 120,000 cubic metres of excavated material, whereas the Phase One scheme is expected to generate approximately 160,000 cubic metres.

2.5.27 Following the construction of the Bromford eastern portal, the site would be used as the tunnelling launch site for both tunnel bores; both would launch at the east portal and be received at the west portal.

2.5.28 The compound would be used to manage construction of the Water Orton cutting and the Bromford tunnel and east portal, including finishes.

2.5.29 Tunnelling for the Proposed Development would be likely to generate approximately 341,600 cubic metres of excavated material. The material would be removed from the tunnel on internal HS2 haul roads, with the material being taken to other HS2 work sites for reuse. The Phase One scheme is expected to generate approximately 131,500 cubic metres of excavated material, which is to be removed from the tunnel using public roads.

2.5.30 There would be a temporary material stockpile and a slurry treatment plant within the Bromford tunnel east portal main compound. The compound would include ten approximately 13m high silos, to be used for the storage of bentonite for use within tunnelling operations and a 6m temporary pedestrian footbridge for workers to pass between different sections of the compound. The tunnelling and cutting techniques, as described in Volume 1, Sections 6.8 and 6.12 of the 2013 ES, as amended, respectively, would be adopted. Some of these works would be likely to occur at night, particularly with regard to the tunnelling operations.

2.5.31 The Bromford tunnel east portal main compound would be used to manage the construction of the Bromford tunnel. The tunnel boring machine would be driven from the Water Orton site and the tunnel excavated materials would also be removed from this end.

2.5.32 Construction vehicles would form an essential part of the tunnel boring machine logistics and support system; supplying the machines with tunnel lining segments and other consumables using flatbed vehicles from the eastern portal.

2.5.33 Tunnel segments would be brought in and material moved away from site using the haul road between the Bromford east portal site and the M6-M42 link-road. This haul road will be provided as part of the Phase One scheme and will reduce construction vehicles on local roads, with material being moved away to where it is required at other Phase One scheme worksites within the local geographical area and beyond.

2.5.34 The majority of excavated material that would be generated from the construction of the tunnel is expected to be suitable for beneficial reuse in environmental mitigation earthworks either within the Proposed Development or elsewhere along the Phase One route.

2.5.35 The Bromford tunnel east portal (railway systems) satellite compound would be used to facilitate the Bromford tunnel east portal railway systems works for two years and nine months, starting in 2024, including the Bromford tunnel east

portal auto-transformer station and the installation of ventilation fans and other equipment in the tunnel and fit out of the portal building.

2.5.36 See Volume 1, Section 5.17 of the 2013 ES, as amended, for a generic description of power supply features including auto-transformer stations, and Volume 1, Section 6.23 for a description of associated construction activities.

2.5.37 Finalisation works would include reinstatement works adjacent to the tunnel portal. The site restoration and landscape treatment techniques in Volume 1, Sections 6.21 of the 2013 ES, as amended will be adopted.

2.5.38 An electrical substation would be required to provide traction power for the railway and would also be used to provide power to the tunnel boring machine and other associated tunnelling equipment on the site and then to provide traction power within the tunnel. This electrical substation would be constructed by WPD, with the works to be undertaken by WPD and from within the footprint of the substation. It would be located to the south east of Bromford tunnel east portal main compound and the east of Attleboro Lane overbridge on land within 2017 Act limits. A separate planning consent is being sought by WPD for the electrical substation, however the impacts of those works associated with the electrical substation have been assessed cumulatively as part of this screening exercise.

Bromford tunnel intermediate shaft satellite compound

2.5.39 This compound (see Map Book: Figure 2.2 (Sheet 2), B4 to A4) would be used for the civil engineering works associated with the Bromford tunnel intermediate shaft. The construction compound would:

- be in place for four years, starting in 2021;
- support approximately 40 workers each day throughout much of the civil engineering works period;
- not provide overnight worker accommodation;
- be accessed via Tameside Drive from the A452 Chester Road (to the west); and
- be managed from the Bromford tunnel east portal main compound.

2.5.40 A programme for the key works associated with this compound is shown in Figure 2.5. Works in this section of the Proposed Development would be carried out in the following broad phases:

- set-up diaphragm wall plant;
- install diaphragm walls;
- excavate shaft and install propping;
- install de-watering system (if required);

- construct shaft base and walls;
- tunnel breakthrough to form connection with vent shaft;
- internal reinforced concrete fit-out; and
- construction of headhouses.

2.5.41 The compound would be used to manage construction of the Bromford tunnel intermediate shaft, which would take approximately three years and nine months to construct. Volume 1, Section 5.7 of the 2013 ES, as amended, provides a description of a typical vent shaft, and Volume 1, Section 6.14 of the 2013 ES, as amended, describes the activities associated with vent shaft construction.

2.5.42 The demolition of four buildings has previously been undertaken at British Car Auctions, Langley Drive, Castle Bromwich to facilitate the Phase One scheme. No further demolitions would be required as a result of the Proposed Development.

2.5.43 No diversions of any roads would be required.

2.5.44 No alternative routes of public rights of way would be required.

2.5.45 No utility diversions would be required.

2.5.46 The utilities construction technique described under advance works in Volume 1, Section 6.4 of the 2013 ES, as amended, would be adopted for this work.

2.5.47 The intermediate shaft would be located in a similar location as the previous east portal structure located at the Castle Bromwich Business Park.

Material changes to the construction process for the Phase One scheme

2.5.48 The construction proposals outlined above and within Table 2.5.1 below for the Proposed Development would provide the outlined environmental, social and cost benefits over the construction of the Phase One scheme.

Table 2.5.1 Changes in construction methodology or requirement between the Phase One scheme and the Proposed Development

Construction methodology or requirement	Phase One Scheme	Proposed Development
Tunnelling operations	Both tunnel bores to be launched from the western portal with all materials, including tunnel ring deliveries and tunnel arisings removal to be undertaken from the western portal,	Both tunnel bores would be launched at the eastern portal, rather than the west. Material would be transported to and from the east portal via haul roads. This change would result in reducing the number of heavy goods vehicle

Construction methodology or requirement	Phase One Scheme	Proposed Development
	situated within Drew's Lane Industrial Estate in Birmingham.	movements the M6 between Junctions 4A and 5 and the A452 Chester Road in Birmingham.
B4118 Water Orton Road overbridge	The replacement of the B4118 Water Orton Road overbridge is required to extend the bridge over the Water Orton cutting, which will require temporary traffic management measures.	As the Proposed Development would pass beneath this area in tunnel, there would be no requirement to replace this road bridge and therefore no construction impacts associated with the closure of the B4118 Water Orton Road.
Temporary works within Park Hall nature reserve	The land required for the construction of the Phase One scheme includes the majority of Park Hall nature reserve in order to install the River Tame viaduct, Plants Brook underbridge and Dunlop carrier channel culvert satellite compounds and to undertake the work associated with these compounds. The Phase One scheme also requires the removal of 0.7ha of ancient woodland and 2.7ha of broadleaved semi-natural woodland, along with reduced impact to other habitats.	The Proposed Development would not require any of these compounds to be installed within the nature reserve. The only works required within the reserve would be the monitoring of existing utilities above tunnelling operations and the removal of the temporary construction haul road that has already been constructed as part of the Phase One scheme. The Proposed Development would not require the removal of any ancient woodland and will reduce impacts to habitats including species-rich grassland and marshland.
Permanent works within Park Hall nature reserve	The Phase One scheme requires permanent land take from the nature reserve for the Water Orton cutting, Park Hall Wood embankment, River Tame viaduct, Park Hall retained fill, the River Tame realignment and replacement floodplain storage.	The temporary access track would be removed following construction and the habitat reinstated.
River Tame	The Phase One scheme requires the realignment of the River Tame, and also the Plants Brook and Dunlop Carrier Drain tributaries through the Park Hall nature reserve.	The Proposed Development land use requirements would mean that there will be no temporary impacts to the River Tame, and the river would no longer need to be diverted.
Existing railway network	The construction of the Phase One scheme requires modifications to the existing Network Rail Birmingham and Derby railway line including railway systems to accommodate the construction of Park Hall retained fill, Langley Hill embankment and balancing ponds.	Since these works would not be required to be constructed as part of the Proposed Development, modifications to the existing railway network would no longer required.
Demolitions	The Phase One scheme requires land within Castle Bromwich Business Park and Haywards Industrial Park, involving the following demolitions:	As the Proposed Development would require a considerably smaller land requirement for the construction of the intermediate shaft, there would be no

Construction methodology or requirement	Phase One Scheme	Proposed Development
	three-storey industrial recycling facility, Tameside Drive, Castle Bromwich Business Park; two single-storey brick industrial premises, Units 7, 8, 9, 10, 11, 12, 13, 14, 14a Orton Way, Hayward Industrial Estate; and a single-storey brick industrial premises, Units 15, 16, 17, 18, 19, 20 Orton Way, Hayward Industrial Estate; and a single-storey, steel frame canopy; one single-storey, steel frame car wash; one two-storey office; two single-storey commercial/office buildings; all at British Car Auctions, Langley Drive, Castle Bromwich. The work within Park Hall nature reserve also requires the demolition of four steel frame electricity pylons within Park Hall nature reserve.	requirement for land within the Haywards Industrial Park and the only demolitions at the Castle Bromwich Business Park required would be the single-storey, steel frame canopy; one single-storey, steel frame car wash; one two-storey office; and two single-storey commercial/office buildings; at British Car Auctions, Langley Drive, Castle Bromwich. The buildings have already been demolished as part of the Phase One scheme. The Proposed Development would not require the demolition of any electricity pylons.

2.6 Operation

2.6.1 Although the target delivery date for the Phase One scheme has been revised to 2029-2033, the original operational date of 2026 has been referenced within this document to ensure that the assessment is consistent with that undertaken within the original ES and all works associated with the Proposed Development would be completed by that date.

Operational specification

2.6.2 Volume 1, Section 4 of the 2013 ES, as amended, describes the envisaged operational characteristics of Phase One of HS2 as a whole and how they may change when Phase Two is also operational. The Proposed Development would not make any significant difference to those operational characteristics.

HS2 services

2.6.3 It is anticipated that, with Phase One scheme in operation, initially there would be three trains per hour each way passing through the Castle Bromwich and Bromford area. The first trains of the day would leave the terminus stations no earlier than 05:00 Monday to Saturday (and 08:00 on Sundays) and the last would arrive no later than midnight. The Proposed Development would not alter the number of passenger trains passing through the area.

2.6.4 It is anticipated that when the Phase 2a and Phase 2b schemes become operational, train frequency could rise to nine trains per hour each way. An additional empty train may pass through the area during certain early morning (post 5am) or late night pre-midnight hours. Between 6am and 7am, ten trains are planned to pass through in the area; nine passenger services from Curzon Street station and one empty train from Washwood Heath depot to Euston Station in London. The assessment of sound, noise and vibration included in Section 13 of this document has taken into account the frequency during Phase Two.

2.6.5 In this area, trains will run at speeds up to 230kph (145mph). The trains will be either single 200m long trains or two 200m long trains coupled together, depending on demand and time of day.

2.6.6 These assumptions are consistent with those included within the Phase One Environmental Assessment, as amended.

Maintenance

2.6.7 Volume 1, Section 4 of the 2013 ES, as amended describes the maintenance regime for the Phase One scheme, and those arrangements will be unaltered by the Proposed Development.

3 EIA Screening Assessment

3.1 Scope of the EIA screening report

3.1.1 This EIA screening report compares the relevant aspects of the Phase One scheme with the Proposed Development to determine whether the Proposed Development is likely to create any new or different significant adverse effects on the environment by virtue of factors such as its nature, size or location.

3.2 Environmental baseline

3.2.1 Significant environmental effects are described in terms of the extent of change to the baseline environment. Each technical section has therefore identified the spatial extent of the study area used for the baseline assessment and described the corresponding baseline information. Where appropriate, the current baseline has been extrapolated into the future to take account of predicted or anticipated variations due to factors such as changing climatic conditions, policy, legislation, advances in technology and future developments. This is known as the future baseline. Future baseline conditions may also be altered by other committed developments. Committed developments are defined as developments which have planning permission or for which sites have been allocated in adopted development plans, which are on or close to the Proposed Development; these are identified in Section 2 of this report. Future baseline considers committed developments that are due to be implemented prior to construction or operation of the Proposed Development, as relevant, through extrapolation of existing conditions.

3.3 Identification of potential new or different significant adverse environmental effects

3.3.1 The assessment of new or different significant adverse environmental effects has been undertaken by firstly considering the effects of the Phase One scheme, then assessing the effects of the Proposed Development, followed by making a different comparison between the effects of the Phase One scheme and the effects of the Proposed Development.

3.4 Mitigation

3.4.1 Mitigation measures were identified by reviewing environmental effects identified during the assessment process. Design modifications were adopted where required to avoid or reduce significant adverse effects. Mitigation will also be achieved through implementation of HS2 Policy and the CoCP, which have been informed by best practice. An overview of different types of mitigation is

provided within Volume 1 of the 2013 ES. The Secretary of State requires design and construction to adhere to arrangements provided for in the 'Environmental Minimum Requirements' (EMRs), to ensure that impacts which have been assessed will not be exceeded; these are set out in a suite of documents (including the CoCP) that accompany the 2017 Act. Mitigation that is pertinent to each environmental discipline is set out within each of the environmental topic sections in this report, where relevant.

3.5 Cumulative effects

3.5.1 Cumulative effects are those that result from a combination of a number of individual effects, which are considered in this report. They may result either from a combination of effects arising from the Proposed Development (intra-project effects) or from an interaction between the effects of the Proposed Development with the effects of other reasonably foreseeable developments that are likely to be under construction or to have been completed at the same time (inter-project effects). Cumulative effects can be either temporary or permanent and can broadly arise from a number of individual environmental impacts (e.g. noise, dust and traffic) on a receptor that, in combination, are likely to have a significant effect; the accumulation of individual effects on a type of receptor (e.g. an ecological species) which when summed are likely to result in an effect of greater significance than individual effects; and the effects from other committed developments in the vicinity of the Proposed Development (during their construction and/or operation), which when combined with the effects of the Proposed Development are likely to have an incrementally significant effect on the receptors that experience both effects. Committed developments expected to be completed after construction of the Proposed Development has commenced and at/before the point when the Proposed Development is operational may give rise to cumulative construction effects. Those expected to be completed during construction of the Proposed Development or at/following the start of operation may give rise to cumulative operational effects.

3.6 Assumptions and limitations

3.6.1 Third party information/data received for the purposes of this screening report is assumed to be correct. Assumptions and limitations that are discipline specific are referred to in the relevant topic sections.

4 Agriculture, forestry and soils

4.1 Introduction

4.1.1 The environmental baseline relevant to the agriculture, forestry and soils assessment is described below. Any new or different likely significant adverse environmental effects on the affected land holdings as a result of the Proposed Development are identified and compared to those reported in the 2013 ES, as amended.

4.2 Scope, assumptions and limitations

4.2.1 Key assumptions, limitations and assessment of the likely effects of the Proposed Development on agricultural and forestry resources within the affected land holdings has been undertaken in accordance with Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and SMR Addendum (Volume 5: Appendix CT-001-000/2) of the 2013 ES, as amended. Throughout and where applicable, information from the 2013 ES was considered in accordance with the relevant SESs and AP ESs (AP1 ES, SES1 and AP2 ES, SES3 and AP4 ES), as well as subsequently published HS2 soil survey records.

4.2.2 In line with the 2013 ES, as amended, baseline and impact assessments of agricultural and forestry resources both principally consider the area and quality of soil resources likely to be impacted within each land holding affected by the Proposed Development. Assessment of soil resource quality primarily considers the Agricultural Land Classification (ALC) of soil resources, which acts as a measure of agricultural capability. In addition to provisional ALC mapping utilised within the 2013 ES, as amended, ALC records from subsequent soil surveys were also considered to provide updated, empirical evidence of on-site soil quality. This section corresponds solely to soils located within the top 1.2m of the soil profile in line with ALC guidelines.

4.2.3 Other effects considered include impacts on farm and rural enterprises from the Proposed Development, as well as indirect effects such as severance and pollution. Notably, both temporary effects (e.g. land that is only required or severed during construction), and permanent effects (those that remain beyond the completion of construction, including land permanently required or severed) are evaluated. The implementation of the committed developments identified in section 2 of this report would not alter baseline information or the predicted effects of the proposal in respect of Agriculture, Forestry and Soils.

4.2.4 The SMR, and its addendums, to the 2013 ES, as amended, provide a framework for which ‘major’ and ‘moderate’ effect significance categories are considered to

constitute 'significant' effects on agricultural and forestry resources within land holdings. 'Minor' and 'negligible' significance categories are deemed 'not significant'. These significance categories are derived from assessment of effect magnitude in conjunction with receptor sensitivity, and, for the purposes of the EIA Regulations, are used as the significance criteria throughout this section.

4.2.5 The extension of the Bromford tunnel, for which further details regarding design features are included in Section 2, will impact four land holdings (CFA19/8, CFA25/1, CFA25/2 and CFA25/3), as described below. The likely significant environmental effects of the Proposed Development on these holdings have been identified in accordance with the above scope and methodology and compared with the Phase One scheme effects.

4.3 Environmental baseline

Existing baseline

4.3.1 Baseline information relating to Agriculture, Forestry and Soils from the 2013 ES, as amended, is summarised below for each of the land holdings located within the area of the Proposed Development.

Table 4.3.1 Agriculture, Forestry and Soils baseline

Land holding	Baseline characteristics
CFA19/8 (Newlands Farm)	Medium sensitivity to change. Total area of 93.1ha of mixed arable and livestock, although the Proposed Development is only likely to affect the most western land parcel, which comprises approximately 4.0ha. Affected land parcel classified as ALC Grade 3a ('Good' quality) land. Soils in the affected parcel of the land holding are shown to comprise the Arrow Soil Association ('deep well drained coarse loamy and sandy soils locally over gravel') and Brockhurst 1 Association ('slowly permeable seasonally waterlogged reddish fine loamy over clayey soils').
CFA25/1 (Twisted Oak Stables)	High sensitivity to change. Total area of 11.8ha equestrian land. ALC Grade 3a ('Good' quality) land. Soils in the affected parcel of the land holding are shown to comprise the Frome ('shallow calcareous and non-calcareous loamy soils'), Fladbury 1 ('stoneless clayey soils, in places calcareous variably affected by groundwater') and Arrow Soil Associations ('deep well drained coarse loamy and sandy soils locally over gravel').
CFA25/2 (Land north of B4118 Birmingham Road)	Low sensitivity to change. Total area of 2.3ha equestrian land.

Land holding	Baseline characteristics
	ALC Grade 3a ('Good' quality) land. Soils in the affected parcel of the land holding are shown to comprise the Fladbury 1 ('stoneless clayey soils, in places calcareous variably affected by groundwater') Soil Association.
CFA25/3 (Park Hall Nature Reserve)	Low sensitivity to change. Total area of 40.1ha nature conservation land. With the exception of a small (approximate 0.7ha) area of land mapped as ALC Grade 3b ('Moderate' quality) in the east of the holding, there is predominantly no ALC Grade recorded at baseline as the land holding contains ecological soils as part of the Nature Reserve. Park Hall Wood ancient and semi-natural woodland is located in three parts along the southern boundary of the holding, covering a combined area of approximately 6.9 ha. Langley Woods ancient and semi-natural woodland is also located towards the south-western extent of the holding, covering an area of approximately 2.3ha. Soils in the affected parcel of the land holding are shown to comprise the Frome ('shallow calcareous and non-calcareous loamy soils') and Fladbury 1 Associations ('stoneless clayey soils, in places calcareous variably affected by groundwater').

Future environmental baseline

Construction

4.3.2 Due to the extension of the bored tunnel, a smaller area of land will be required during the construction of the Proposed Development than for the scheme stated within the 2013 ES, as amended. In particular, and as described within Section 2, land required during construction within Park Hall Nature Reserve (CFA25/3) will be limited to the installation of a temporary construction access road and the monitoring of existing underground utilities throughout tunnelling operations.

4.3.3 The committed developments identified in Section 2 of this report would not alter baseline information in respect of agriculture, forestry and soils.

Operation

4.3.4 Due to the extension of the bored tunnel, a smaller area of land will be required during the operation of the Proposed Development than for the scheme stated within the 2013 ES, as amended. In particular, and as described within Section 2, this includes a reduced area of land to be acquired permanently in Twisted Oak Stables (CFA25/1) and Park Hall Nature Reserve (CFA25/3).

4.3.5 In line with the 2013 ES (Volume 2, CFA 25), as amended, once construction is complete land required temporarily will be reinstated to its pre-existing

agricultural condition by following appropriate sustainable soil handling guidance.

4.3.6 The committed developments identified in section 2 of this report would not alter baseline information in respect of agriculture, forestry and soils.

4.4 Effects arising during construction

Avoidance and mitigation measures

4.4.1 The ongoing design and construction of the Proposed Development will be undertaken in accordance with the EMRs contained within the corresponding suite of documents which sit in conjunction with the 2017 Act.

4.4.2 Embedded scheme mitigation, where relevant, remains as stated in the 2013 ES, as amended, in accordance with the design features detailed in section 2.

4.4.3 With regard to localised effects during the construction phase, Farm Pack Soil Resource Plans for each affected land holding will provide mitigation to protect soil resources likely to be disturbed during the construction of the Proposed Development. Based on HS2 soil survey data, the measures offered within these documents pertain to the stripping, stockpiling, maintenance, reinstatement and aftercare required for the topsoil and subsoil resources.

Assessment of construction impacts and effects

4.4.4 A comparative assessment of the temporary effects of the Phase One scheme and Proposed Development on the affected land holdings within CFA19 (Coleshill Junction) and CFA25 (Castle Bromwich and Bromford) was carried out and is summarised below.

Table 4.4.1 Comparison of effects arising during construction between the Phase One scheme and Proposed Development

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during construction	Proposed Development - Effects during construction
CFA19/8 (Newlands Farm)	Assets retained from the Phase One scheme: Water Orton Cutting and Retaining Structure Attleboro Lane Overbridge, WPD Substation Assets removed from the land holding as part of the Proposed Development: None	Only the most western land parcel of the land holding (the land located west of Attleboro Lane, comprising approximately 3ha out of 93.1ha total) is to be impacted by the Phase One Scheme. At baseline, approximately 3ha (75%) of this land is shown as land being required during construction.	As for the Phase One scheme, only the most western land parcel is to be affected by the Proposed Development. Within this land parcel, there is no notable difference in the area of land required during construction, which remains in line with that reported in the 2013 ES, as amended. To this end, of the 4ha area,

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during construction	Proposed Development - Effects during construction
		This proportion of land to be acquired temporarily represents a High impact.	approximately 3ha (75%) is to be impacted by the Proposed Development, dictating that this is a High impact.
		This 2013 ES, as amended, highlights that the affected CFA19/8 land parcel exclusively comprises Best and Most Versatile land (ALC Grade 3a – 'Good'). This has been identified in both baseline mapping and a HS2 Soil Survey borehole within the northern field of the western land parcel (borehole reference: WK430707_0551). As a consequence, the Phase One scheme would result in the temporary loss of approximately 3ha ALC Grade 3a ('Good') land (High impact).	Given that there is no notable change from the area of land required during construction associated with the Proposed Development, the loss of Grade 3a ('Good') land remains in line with that identified within the 2013 ES, as amended (High impact).
		Within the affected western land parcel of CFA19/8, disruptive effects of construction are noted to likely include potential noise disruption to both stock and residences, with agricultural land rendered unviable (Medium impact).	Disruptive effects associated with the Proposed Development remain in line with those identified within the 2013 ES, as amended (Medium impact).
		Overall assessment of temporary construction effect: Major/Moderate effect – **significant**.	There are no new or different significant adverse effects anticipated due to the Proposed Development. These remain in line with those identified within the 2013 ES, as amended. Overall assessment of temporary construction effect: Major/Moderate effect – **significant**.

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during construction	Proposed Development - Effects during construction
CFA25/1 (Twisted Oak Stables)	Temporary features included within the Proposed Development: haul road, Bromford tunnel east portal main compound Assets removed from the land holding as part of the Proposed Development: Water Orton Road overbridge, Water Orton cutting and retaining structure	All land within the holding to the north of the Birmingham Road is noted to be required for ecological mitigation works associated with the Phase One scheme. Land is also affected by the diversion of an oil pipeline. However, there are no land severances. The total area of 8.3ha (70% of total holding area) required for construction throughout the land holding is classified as a High impact.	Although Bromford tunnel will run through the south-western section of the land holding, as this is bored, this will not require land during construction. The associated temporary features will require less land to be acquired temporarily than that identified for the Phase One scheme, with the incorporation of the Bromford tunnel east portal main compound requiring an area of approximately 2.8ha land in the land north of Birmingham Road, as well as an area of approximately 1.5ha in the land to the south of Birmingham Road. There remain no land severances associated with the Proposed Development. The proportion of affected land (4.3ha, equivalent to approximately 36% of the total holding area) remains classified as a High impact, despite the reduction in construction land-associated with the Proposed Development.
		HS2 soil survey information in the land situated to the north of Birmingham Road indicates that this equestrian land comprises ALC Grade 3b land ('Moderate', non-Best and Most Versatile Land). To the south of Birmingham Road, the CFA25/1 land is predominantly identified to comprise Best and Most Versatile Land (Grade 2, 'Very Good', and 3a, 'Good').	The reduction in land required during construction reduces the disturbance of soil resources throughout the land holding, including Best and Most Versatile Land. However, this remains in line with a Medium impact.

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during construction	Proposed Development - Effects during construction
		As a consequence, the Phase One scheme would result in the temporary loss of Grade 3b land in the northern section, as well as Best and Most Versatile Land (ALC Grades 2 and 3a) in the southern section. This is in line with a Medium impact.	
		Range of disruptive effects expected in the 2013 ES, as amended: access to the holding is likely to be disrupted, while the proximity of the works to the stable buildings is likely to render them unviable (Medium to High impact).	The level and type of disruptive effects are not likely to change due to the Proposed Development. As such, this remains in line with the impact identified for the Phase One scheme (Medium to High impact).
		Overall assessment of temporary construction effect: Major effect – **significant**.	While the area of land required during construction is reduced by the Proposed Development and there are no new or different significant adverse effects, impact magnitudes remain in line with those identified for the Phase One scheme. Accordingly, the overall temporary assessment is Major effect – **significant**.
CFA25/2 (Land north of B4118 Birmingham Road)	None.	2.3ha (100% of total holding area) required for construction of ecological mitigation works. No land severances. Loss of stables and use of associated land (High impact).	Although the ecological mitigation works are no longer required as part of the Proposed Development, a construction storage area is proposed to occupy the total area of the land holding during construction (2.3ha, 100% of total holding area). As such, this will remain as a High impact during construction.

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during construction	Proposed Development - Effects during construction
		This 2013 ES, as amended, indicates that CFA25/2 comprises ALC Grade 3a ('Good') land, which falls under the categorisation of Best and Most Versatile Land. The requirement for this land during construction therefore represents a High impact.	In accordance with the location of the proposed construction storage area within the holding, the same area of ALC Grade 3a ('Good') Best and Most Versatile Land will be required as that reported for the Phase One scheme. During the construction stage, this therefore still represents a High impact.
		Due to Low land holding sensitivity, the overall temporary assessment included in the 2013 ES, as amended, resulted in: Moderate effect – **significant**.	As the same area of land within the land holding will be required during construction as that identified for the Phase One scheme, there are no new or different significant adverse effects anticipated due to the Proposed Development. The overall temporary assessment remains classified as: Moderate effect – **significant**.
CFA25/3 (Park Hall nature reserve)	Assets removed from the land holding as part of the Proposed Development: River Tame viaduct, River Tame realignment, High Voltage overhead line diversion	The eastern part of the nature reserve (which will form a residual unaffected area) will be severed from its existing access from the Birmingham Road. However, it is stated in the ES (as amended) that the Phase One scheme included provision for a replacement, which may have been available during construction. 37.9ha (95% of total holding area) required for construction (High impact).	Surface construction will be limited to the tunnel monitoring stations and associated access route only. This represents an approximate area of 6.7ha (16.7% of the holding area), corresponding to a Medium impact.
		Construction will result in the disturbance of ALC Grades 1 ('Excellent'), 2 ('Very Good'), 3a ('Good') and Grade 3b ('Moderate') land, all of which have been identified in	The Proposed Development will result in a smaller area of soil resources (ALC Grades 2, 3a and 3b) being required for construction.

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during construction	Proposed Development - Effects during construction
		proximal soil boreholes. Land required for the Phase One scheme also requires the removal of 0.7ha of ancient woodland and 2.7ha of broadleaved semi-natural woodland The disturbance of this proportion of Best and Most Versatile Land during construction represents a High impact.	Despite the reduced area of land required, the high proportion of Best and Most Versatile Land within this means that this represents a High impact, in line with that identified for Phase One.
		Disruptive effects mostly associated with the loss of a variety of habitats due to remodelling of the floodplain to provide more effective flood capacity. This represents a High impact.	Disruptive effects are likely to centre around the use of the haul road and ongoing monitoring, which may affect access to the land holding and still cause disruption to a comparable level as specified for the Phase One scheme. This therefore represents a High impact.
		Due to Low land holding sensitivity, the overall temporary assessment included in the 2013 ES, as amended, resulted in: Moderate effect – **significant**.	There are no new or different significant adverse effects anticipated due to the Proposed Development. Despite the notable reduction in the area of land required during construction, there will still be High impacts associated with the disturbance of Best and Most Versatile Land and disruption to the land holding. Overall temporary assessment: Moderate effect – **significant**.

Other mitigation and residual effects

4.4.5 No mitigation measures beyond those identified in the 2013 ES, as amended, are proposed and therefore effects are as described above.

Cumulative effects

4.4.6 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

4.5 Effects arising during operation

Avoidance and mitigation measures

4.5.1 The ongoing design and construction of the Proposed Development will be undertaken in accordance with the EMR contained within the corresponding suite of documents which sit in conjunction with the 2017 Act.

4.5.2 Embedded scheme mitigation remains as stated in the 2013 ES, as amended, in accordance with the design features detailed in section 2.

4.5.3 With regard to localised effects on soil resources during the construction phase, Farm Pack Soil Resource Plans will be produced for each affected land holding setting out the mitigation measures to protect soil resources likely to be disturbed permanently within each holding. Tailored to HS2 soil survey data, the measures offered within these documents pertain to the stripping, stockpiling, maintenance, reinstatement and aftercare required for the topsoil and subsoil resources in accordance with the SMR.

Assessment of impacts and effects

4.5.4 Table 4.5.1 presents a summary of the comparative assessment of effects during operation between the Phase One scheme and Proposed Development. This section notes these impacts with regard to the affected land holdings within CFA19 (Coleshill Junction) and CFA25 (Castle Bromwich and Bromford).

4.5.5 The impacts associated with the Proposed Development are primarily concerned with the bored tunnel and assets located in undeveloped land within the affected land holdings CFA19/8, CFA25/1, CF25/2 and CFA25/3, with no affected land holdings and no impacts to Agriculture and Soils anticipated in the western, urban extent of the Proposed Development (namely in relation to the Bromford intermediate shaft and Bromford tunnel east portal).

Table 4.5.1 Comparison of effects arising during operation between the Phase One scheme and Proposed Development

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during operation	Proposed Development – Effects during operation
CFA19/8 (Newlands Farm)	Assets retained from the Phase One scheme: Water Orton cutting and retained structure, Attleboro Lane overbridge, WPD Substation. Assets removed from the land holding as part of the Proposed Development: None.	Only the most western land parcel of the land holding (the land located west of Attleboro Lane, comprising approximately 3ha out of 93.1ha total) is to be required during the operation of the Phase One Scheme. Within the Phase One scheme, approximately 3ha (75%) of this land is shown as land being required during operation of the Phase One scheme. This proportion of land to be acquired permanently represents a High impact.	As for the Phase One scheme, only the most western land parcel is to be required by the Proposed Development during operation. Within this land parcel, there is no notable difference in the area of land required during operation, which remains in line with that reported in the 2013 ES, as amended. To this end, of the 4ha area, approximately 3ha (75%) is to be impacted by the Proposed Development, representing a High impact.
		This 2013 ES, as amended, highlights that the affected CFA19/8 land parcel exclusively comprises Best and Most Versatile land (ALC Grade 3a – 'Good'). This has been identified in both baseline mapping and a HS2 Soil Survey borehole within the northern field of the western land parcel (borehole reference: WK430707_0551). As a consequence, the Phase One scheme would result in the permanent loss of approximately 3ha ALC Grade 3a ('Good') land (High impact).	Given that there is no notable change in the area of land required during operation of the Proposed Development, the loss of Grade 3a ('Good') land remains in line with that identified within the 2013 ES, as amended (High impact).

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during operation	Proposed Development – Effects during operation
		Within the total land holding, a range of disruptive effects during operation are noted within the 2013 ES, as amended. These include severance of drainage systems, water supply systems and loss of farm infrastructure (Medium impact).	As the area required for the operation of the Proposed Development is in line with that recorded for the Phase One scheme, the disruptive effects remain as with those recorded in the 2013 ES, as amended (Medium impact). Notably, however, these impacts will be restricted to the most western land parcel of CFA19/8, which is the only part of CFA19/8 affected by the Proposed Development.
		Overall permanent assessment: Major/Moderate effect – **significant**.	There are no new or different significant adverse effects anticipated due to the Proposed Development. These remain in line with those identified within the 2013 ES, as amended. Overall permanent assessment: Major/Moderate effect – **significant.**
CFA25/1 (Twisted Oak Stables)	Assets retained from the Phase One scheme: None. Assets removed from the land holding as part of the Proposed Development: Water Orton Road overbridge, Water Orton cutting and retained structure.	All land within the holding to the north of the Birmingham Road is noted to be required for ecological mitigation works associated with the Phase One scheme. Land is also affected by the diversion of an oil pipeline. However, there are no land severances. The extent of permanent land requirements for railway and ecological mitigation works may render continued commercial use of the stables and exercise area unsustainable.	Limited disruption post-construction associated with permanent features due to the removal of construction buildings and nature of the bored tunnel, as well as the removed ecological mitigation north of Birmingham Road. There are no permanent features planned in the area, with no severances expected. Given the absence of permanent features and provided that suitable soil

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during operation	Proposed Development – Effects during operation
		The total area of 7.6ha (64% of the total holding area) required during operation represents a High impact.	reinstatement practices (in line with Farm Pack Soil Resource Plans) are adhered to, permanent effects on the land holding are anticipated to be negligible. However, there remains the potential that the nature and extent of the land required temporarily (30% of the holding, Table 4.4.1) renders the continued use of the equestrian unit unsustainable given its High sensitivity (as identified in the 2013 ES, as amended). On a precautionary basis, this represents a High impact.
		HS2 soil survey information in the land situated to the north of Birmingham Road indicates that this equestrian land comprises ALC Grade 3b land ('Moderate', non-Best and Most Versatile Land). To the south of Birmingham Road, the CFA25/1 land is predominantly identified to comprise Best and Most Versatile Land (Grade 2, 'Very Good', and 3a, 'Good'). As a consequence, the Phase One scheme would result in the permanent loss of Grade 3b land in the northern section, as well as 2 Best and Most Versatile Land (ALC Grades 2 and 3a) in the southern section. This is in line with a Medium impact.	The absence of permanent features within the land holding and associated reduction in land required during construction reduces the disturbance of soil resources throughout the land holding, including Best and Most Versatile Land. This represents a Negligible impact.

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during operation	Proposed Development – Effects during operation
		Overall permanent assessment: Major effect – **significant**.	There are no new or different adverse significant effects anticipated due to the Proposed Development, as there are no permanent features situated within the land holding. However, due to the High sensitivity of the land holding, there remains potential that the nature and extent of the land required temporarily renders the continued use of the equestrian unit unsustainable. Due to this, on a precautionary basis, the overall permanent assessment remains in line with that identified for the Phase One scheme. Overall permanent assessment: Major effect – **significant**.
CFA25/2 (Land north of B4118 Birmingham Road)	None.	The land holding is not noted as having any permanent effects as it is removed at the construction stage.	There are no new or different significant effects adverse anticipated due to the Proposed Development. Following the appropriate reinstatement of any soil stripped to accommodate the temporary storage area during construction, there are no permanent features planned in the land holding area, so there are no permanent effects anticipated due to the Proposed Development. Overall permanent assessment: Negligible impact – **not significant.**

Land holding	Phase One scheme assets likely to be affected by the Proposed Development	Phase One scheme – Effects during operation	Proposed Development – Effects during operation
CFA25/3 (Park Hall Nature Reserve)	Assets removed from the land holding as part of the Proposed Development: River Tame viaduct, River Tame realignment, HV overhead line diversion.	Land affected by remodelling for flood management purposes will be reinstated using conserved soil resources and be available for nature conservation purposes compatible with the flood management function. No land severances are anticipated. 6.2ha land (16% of total holding area) required permanently (Medium impact).	No permanent effects or land severances on the land holding are anticipated due to the bored nature of Bromford tunnel and absence of permanent features associated with the Proposed Development, as well as the reinstatement of the haul road following construction (Negligible impact).
		Best and Most Versatile Land in the form of ALC Grades 1 ('Excellent'), 2 ('Very Good') and 3a ('Good') have been identified in proximal soil boreholes, as well as Grade 3b ('Moderate') land. The disturbance of this proportion of Best and Most Versatile Land during construction represents a High impact.	Following haul route reinstatement after the construction phase, the absence of permanent features within the land holding as part of the Proposed Development means that there are not any anticipated effects on Best and Most Versatile Land or other soil resources (Negligible impact).
		Overall permanent assessment: Minor effect – **not significant**.	There are no new or different significant adverse effects anticipated due to the Proposed Development, which does not incorporate any permanent features that would affect the holding above the bored tunnel. Further to haul road soil reinstatement, during operation, there is therefore a markedly reduced impact on the overall land holding. Overall permanent assessment: Negligible effect – **not significant**.

Other mitigation and residual effects

4.5.6 No mitigation measures beyond those identified in the 2013 ES, as amended, are proposed and therefore effects are as described above.

Cumulative effects

4.5.7 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

4.6 Summary

4.6.1 No new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme. Instead, the Proposed Development is likely to result in an overall reduction in adverse effects on agriculture and soils within the affected land holdings.

4.6.2 A summary of the effects on Agriculture, Forestry and Soils resulting from the incorporation of the Proposed Development (as compared with the Phase One scheme) is presented in Table 4.6.1, below.

4.6.3 The extension of the Bromford tunnel is likely to largely minimise disturbance to soil resources within the affected land holdings, as also reflected in Table 4.6.1, below.

Table 4.6.1 Summary of differences in effects on Agriculture, Forestry and Soils between the Phase One scheme and Proposed Development

Land holding	Stage	Temporary significant adverse effects	Permanent significant adverse effects
CFA19/8 (Newlands Farm)	Phase One scheme	Major / moderate – **significant**.	Major / moderate – **significant**.
	Proposed Development	Major / moderate – **significant**.	Major / moderate – **significant**.
CFA25/1 (Twisted Oak Stables)	Phase One scheme	Major – **significant**.	Major – **significant**.
	Proposed Development	Major – **significant**.	Major – **significant**.
CFA25/2 (Land north of B4118 Birmingham Road)	Phase One scheme	Moderate – **significant**.	The land holding is not noted as having any permanent effects as it is removed at the construction stage.
	Proposed Development	Moderate – **significant**.	Negligible – **not significant**.
	Phase One scheme	Moderate – **significant**.	Minor – **not significant.**

Land holding	Stage	Temporary significant adverse effects	Permanent significant adverse effects
CFA25/3 (Park Hall Nature Reserve)	Proposed Development	Moderate – **significant**.	Negligible – **not significant.**

4.6.4 With regard to agriculture, forestry and soils, in comparison to the Phase One scheme there would be a decrease in the area of Best and Most Versatile land affected, together with reduced effects on both soil resources and on agricultural land holdings as a result of the Proposed Development. This is most notable for land holdings at Twisted Oak Stables (CFA25/1) and Park Hall nature reserve (CFA25/3) where, following site restoration of temporary construction sites, more land will be returned to agricultural use compared to the Phase One scheme. The Proposed Development will still require the total CFA25/2 (land north of B4118 Birmingham Road) holding area during construction, however, it removes the requirement for any permanent ecological mitigation features in this area. Although there is no reduction in the area of soil resources required for construction at Newlands Farm (CFA19/8), the Proposed Development would only impact its most western land parcel (west of Attleboro Lane), which constitutes 3ha of the 93.1ha total land holding area. There is no change to the area of land required within this holding and given that the effects of the Proposed Development are restricted to this land parcel, any impacts would not alter the effects reported within the 2013 ES, as amended, for the entire holding.

5 Air quality

5.1 Introduction

5.1.1 The environmental baseline relevant to the air quality assessment is described below. This assessment identifies any new or different likely significant adverse environmental effects as a result of the Proposed Development and compare to those reported in the 2013 ES, as amended

5.2 Scope, assumptions and limitations

5.2.1 The assessment scope, key assumptions and limitations for the air quality assessment are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and SMR Addendum (Volume 5: Appendix CT-001-000/2) of the 2013 ES, as amended. This section of the screening assessment follows the same approach.

5.2.2 This assessment focuses on the likely significant effects associated with changes to construction traffic as a result of the Proposed Development being implemented rather than the Phase One scheme in this location. The Design Manual for Roads and Bridges (DMRB) Screening Tool has been used in conjunction with the most up to date emission factors produced by the Department for Food and Rural Affairs (Defra) to assess the effects. Effects from proposed construction activities, particularly in the vicinity of Twisted Oaks Riding Stables, would be controlled and managed through the route-wide implementation of the CoCP and therefore can be considered negligible in terms of impact.

5.2.3 HS2 Ltd. has committed to only using Euro VI heavy goods vehicles (HGVs), Euro 4 petrol and Euro 6 diesel cars and light goods vehicles (LGVs). However, the standard UK vehicle mix emission assumptions have been applied to this assessment in order to present a worst case assessment.

5.2.4 Operationally, and in relation to potential air quality effects, the Proposed Development will remain unchanged from the 2013 ES, as amended. As a result, the effect on local air quality from the operation of the Proposed Development has not changed from the 2013 ES, as amended, where it was determined as not significant and therefore has not been considered further.

5.2.5 This section of the screening considers the CFA25 (Castle Bromwich and Bromford), CFA19 (Coleshill Junction) and CFA20 (Cudworth to Middleton) identified in the 2013 ES, as amended, as relevant changes in construction traffic associated with the Proposed Development are confined to these CFAs.

5.2.6 Section 1 of this report, which takes into account section 2 of this report, provides details of the committed developments that have been included within the traffic data adopted to identify predicted air quality effects with respect to potential cumulative effects.

5.2.7 The legislative context has not changed since the 2013 ES, as amended. Applicable numerical limit values and objectives for the Proposed Development are summarised in Appendix 5.1 of this report and are hereafter referred to as air quality standards.

5.3 Environmental Baseline

Existing baseline

Receptors

5.3.1 Relevant representative human health receptors were selected in the 2013 ES, as amended, at locations representative of the greatest potential change in air quality.

5.3.2 Within CFA 25 (Castle Bromwich and Bromford), the 2013 ES, as amended, assessed 13 relevant representative receptors within 200m of road links which met the DMRB criteria for assessment. These relevant representative receptors are located along the A38 between Gravelly Hill and Birches Green, and adjacent to the northbound carriageway of the M6 between Junction 4a and the A4040 within the area of Castle Bromwich and Bromford. No nationally or European significant designated ecological receptors were identified within the Bromford area, which remains the case for the Proposed Development.

5.3.3 In addition to the 13 relevant representative receptors assessed in the 2013 ES, as amended, 17 further relevant representative human health receptors and one ancient woodland have been identified and assessed due to the expected changes in construction traffic on the local road network. Seven relevant representative human health receptors are located along the A446, two are located along the B4117, two are located along Kingsbury Road and the remaining are located along Tyburn Road, Water Orton Road, the M6 east of Junction 5, Newport Road, Parkfield drive and the B4118, Birmingham Road. An area of ancient woodland (Langley Wood) is located adjacent to the southbound M6 carriageway to the east of the M6 Junction 5. Altogether, there is a total of 31 relevant representative receptors. The locations of these relevant representative receptors have been presented in Appendix 5.2.

Local Air Quality

5.3.4 Information on air quality in the UK can be obtained from a variety of sources including local authorities, national network monitoring sites and other published sources. For the purposes of this assessment, a review of the baseline information set out in the 2013 ES, as amended, has been presented as well as data obtained from the Defra Air Quality Information Resource, Birmingham City Council (BCC), Solihull Metropolitan Borough Council (SMBC) and North Warwickshire District Council (NWDC).

5.3.5 The presence and extent of Air Quality Management Areas (AQMAs) has not changed since the 2013 ES, as amended. Birmingham AQMA is the area primarily relevant to the Phase One scheme and the Proposed Development.

5.3.6 The 2013 ES, as amended, presented two continuous monitoring sites and one diffusion tube site, adjacent to Tyburn Road, which were all decommissioned in 2012.

5.3.7 Measurements of annual mean nitrogen dioxide (NO_2) concentrations were above the air quality standard at the roadside continuous monitor, south of Tyburn Road up until its decommissioning in early 2012. Measurements of annual mean particulate matter (PM_{10}) were within the air quality standard in 2011. No exceedances of the short-term standard were measured at this site for either pollutant.

5.3.8 The second continuous monitoring site was an urban background site, also located south of Tyburn Road, however at a greater distance from the kerbside. The site was also co-located with a diffusion tube. Measurements of annual mean NO_2 were within the air quality standard in 2011 for both the continuous monitor and the diffusion tube. Measurements of annual mean PM_{10} were within the air quality standard in 2011. No exceedances of the short-term standard were measured at this site for either pollutant.

5.3.9 The 2013 ES, as amended, used estimates of background air quality taken from Defra maps. At relevant representative receptors assessed in the 2013 ES, as amended, annual mean NO_2 background concentrations, representative of 2017, ranged from 17 to 27μg/m^3 and annual mean PM_{10} background concentrations ranged from 17 to 20μg/m^3.

5.3.10 No representative continuous monitoring is currently carried out by BCC, SMBC or NWDC in the vicinity of the Proposed Development. The continuous monitors discussed above and in the 2013 ES, as amended, were decommissioned in 2012.

5.3.11 BCC, SMBC and NWDC have extensive diffusion tube networks within their districts. Table 5.3.1 presents nine diffusion tube locations within the vicinity of the Proposed Development. Monitored annual mean NO_2 concentrations exceeded, or were close to exceeding, the annual mean NO_2 air quality standard at two locations in 2018. These two sites (Tyburn (39) & Tyburn (40)) are located north of the A38 Tyburn Road, Gravelly Hill, close to the Salford Circus Roundabout. The Tyburn sites are also located adjacent to the Tyburn Road east bound onslip from the Salford Circus Roundabout which is likely to be subject to slower speeds where the traffic joins the A38 Tyburn Road main eastbound carriageway. Relevant representative receptors adjacent to the Tyburn sites are however set back from the roads edge and are likely to fall below the air quality standard at the façade.

5.3.12 Monitored annual mean NO_2 concentrations at the remaining monitoring locations did not exceed the air quality standard in either 2018 or 2019.

5.3.13 Table 5.3.1 demonstrates that concentrations exceed the NO_2 air quality standard at locations close to the busy routes within the study area, however in suburban areas, within 200m of the M6 and further from the kerbside, monitored concentrations do not exceed the air quality standard.

5.3.14 Defra's TG16 indicates that the hourly NO_2 air quality objective of 200µg/m^3 (not to be exceeded more than 18 times per year) is unlikely to be exceeded at roadside locations where the annual mean concentration is less than 60µg/m^3.

Table 5.3.1 Representative diffusion tube monitoring

Site	Local Authority	Ordnance survey coordinates	Annual mean NO_2 concentration (µg/m^3)					
			2014	2015	2016	2017	2018	2019
BCC Tyburn (39) Roadside[(1)]	BCC	410010, 289995	42	43	48	50	39	-
BCC Tyburn (40) Roadside[(1)]	BCC	410072, 289999	47	44	47	49	41	-
Kingsleigh Drive	SMBC	414292, 289956	-	-	-	29	27	21
Greenfinch Drive	SMBC	417558, 289500	-	-	-	-	32	26
Hurst Lane North	SMBC	416100, 289322	-	-	-	26	-	-
Farthing Lane, Curdworth	NWDC	418186, 292959	-	21	22	23	22	19
Maud Road, Water Orton	NWDC	418060, 290943	-	23	23	28	33	27
Coleshill Heath Road, Coleshill	NWDC	419854, 287041	-	-	-	-	-	34

Site	Local Authority	Ordnance survey coordinates	Annual mean NO_2 concentration (µg/m^3)					
			2014	2015	2016	2017	2018	2019
Coventry Road, Coleshill	NWDC	420027, 287360	-	31	30	30	28	28

Source: BCC 2019 ASR. Correspondence with SMBC and SMBC 2017 ASR, NWDC 2020 ASR. All data has been bias corrected by the respective local authority. SMBC ceased monitoring in 2012 however monitoring was mobilised again in late 2017. SMBC 2018 is an average of 2017/2018 as presented in the latest ASR. Monitoring at Hurst Lane was stopped in 2018.
(1) For sites Tyburn (39) Roadside and Tyburn (40) Roadside, no data is currently available for 2019 at the time of reporting.

5.3.15 Estimates of background air quality, at the 31 relevant representative receptors of the Proposed Development, have been taken from the most current published version of Defra maps. Annual mean NO_2 background concentrations, representative of 2021, range from 17 to 29µg/m^3, annual mean PM_{10} background concentrations range from 14 to 16µg/m^3 and annual mean $PM_{2.5}$ background concentrations range from 10 to 11µg/m^3.

5.3.16 The 2021 Defra predictions indicate that background concentrations at the Proposed Development site do not exceed the relevant air quality objectives.

5.3.17 Although some monitoring in the study area indicates that the NO_2 air quality standard is being exceeded, overall, at relevant representative receptors affected by the Proposed Development, air quality is considered to meet the relevant air quality standards.

5.4 Effects arising during construction

Avoidance and mitigation measures

5.4.1 Mitigation measures are set out in the CoCP. Mitigation for construction is in accordance with best practicable means (BPM), this will include measures such as "*Vehicles and plant will be switched off and secured when not in use*" or *"Damping down of dust generating equipment and vehicles within the site and the provision of dust suppression in all areas of the site that are likely to generate dust.*"

Assessment of impacts and effects

5.4.2 The DMRB Screening Tool[10] has been used to assess the impacts associated with the predicted changes in construction phase traffic movements associated with the Proposed Development during construction in accordance with DMRB LA 105[10] screening criteria, Local Air Quality Management – Technical Guidance 2016, with assessment of significance carried out in accordance with Institute of air quality management (IAQM) and Environmental Protection, UK (EPUK)

[10] Design Manual for Roads and Bridges LA 105 Air quality, November 2019

guidance, 2017. This approach is consistent with the 2013 ES, as amended, however the approach uses updated guidance and model input data, such as emissions factors, as appropriate.

5.4.3 Construction phase traffic data used for this screening assessment has been provided by the Traffic and Transport assessors for this screening report (Section 16 of this report).

Human health receptors

5.4.4 The 2013 ES, as amended, assessed annual mean concentrations of NO_2 and PM_{10} and concluded that air quality effects arising from changes to traffic associated with the construction of the Phase One scheme are anticipated to be not significant. Pollutant concentrations were well below the relevant air quality standards and the impact descriptor at all 13 assessed relevant representative receptors within CFA 25 were reported as negligible. There were also predicted to be no exceedances of the relevant short term (hourly and daily) air quality standards. In accordance with guidance at the time of writing, $PM_{2.5}$ was not assessed in the 2013 ES, as amended.

5.4.5 In accordance with the 2013 ES, as amended, the annual mean concentrations of NO_2, PM_{10} and $PM_{2.5}$ at relevant representative human health receptors are not predicted to exceed the air quality standards during construction of the Proposed Development. In addition, and as consistent with the 2013 ES, as amended, there are no predicted exceedances of the relevant short term (hourly and daily) air quality standards. Relevant representative human health receptors adjacent to the A446 are likely to see the largest increase in HGV movements during construction of the Proposed Development. This is the result of the increase construction vehicles accessing Bromford tunnel east portal main compound.

Ecological receptors

5.4.6 There were no nationally or European designated sites for ecology assessed in the 2013 ES, as amended.

5.4.7 The annual mean NOx concentration at the identified area of ancient woodland is predicted to exceed the NOx air quality standard for the protection of vegetation both without and with the Proposed Development. The change in NOx concentrations are predicted to be small and therefore nitrogen deposition was assessed to determine significance in accordance with DMRB. The change in nitrogen deposition at this site was found to be less than 1% of the minimum critical load assigned to the habitat, therefore no significant effects are anticipated at the ecological receptor as a result of the Proposed Development.

Summary

5.4.8 Pollutant concentrations are well below the relevant air quality standards at relevant representative human health receptors and the impact descriptor at all relevant representative human health receptors is negligible. The change in nitrogen deposition at the relevant representative ecological receptor is negligible. Therefore, air quality effects arising from changes to traffic associated with the construction of the Proposed Development are likely to be not significant.

Other mitigation and residual effects

5.4.9 No other mitigation measures are required and therefore effects are as described above.

Cumulative effects

5.4.10 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

5.5 Effects arising during operation

Avoidance and mitigation measures

5.5.1 Operationally, the air quality effects of the Proposed Development will be consistent with those of the Phase One scheme. Therefore, no new avoidance and mitigation measures are required beyond those specified in the Air Quality Strategy[11].

Assessment of impacts and effects

5.5.2 The air quality effects of the Proposed Development, during operation, will be consistent with those of the Phase One scheme. As a result, the effect on local air quality from the operation of the Proposed Development has not changed in significance from the 2013 ES, as amended, and therefore has not been considered further.

Other mitigation and residual effects

5.5.3 No other mitigation measures are required and therefore effects are as described above.

[11] High Speed Two (2017), High Speed Two Air Quality Strategy, HS2-HS2-EV-STR-000-000007, July 2017. Available at: assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/632198/hs2_air_quality_strategy.pdf [Last Accessed: 02/02/2021]

Cumulative effects

5.5.4 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

5.6 Summary

5.6.1 A review of the existing air quality baseline shows that at relevant representative receptors affected by the Proposed Development, air quality is considered to meet the relevant air quality standards. Effects from proposed construction activities would be controlled and managed through route-wide implementation of the HS2 Code of Construction Practice (CoCP) and therefore can be considered negligible and not significant. Air quality effects arising from changes to traffic associated with the construction of the Proposed Development are anticipated to be not significant. Pollutant concentrations are well below the relevant air quality standards at all relevant representative human health receptors and the impact is negligible and not significant. At the ancient woodland site in the vicinity of the Proposed Development, the change in concentration of nitrogen oxides both without and with the Proposed Development would be imperceptible and therefore would be negligible and not significant. Operationally there are likely to be no new or different significant adverse effects resulting from the Proposed Development, compared with the Phase One scheme.

5.6.2 Therefore, air quality effects arising from changes to traffic associated with the construction of the Proposed Development are likely to be not significant, and will not create any new or different likely significant effects compared to the Phase One Scheme

6 Community

6.1 Introduction

6.1.1 This section reports the potential for significant effects on local communities. Any new or different likely significant adverse effects as a result of the Proposed Development are identified and compared to those reported in the 2013 ES, as amended.

6.2 Scope assumptions and limitations

6.2.1 The assessment scope and methodology for this section of the report is consistent with the method 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) of the 2013 ES, as amended.

6.2.2 The CFA Reports were reviewed to determine where significant effects were previously identified. The two CFA reports from the 2013 ES, as amended, relevant to this assessment are CFA 19 (Coleshill Junction) and CFA 25 (Castle Bromwich and Bromford). The Proposed Development was compared against the relevant aspects of the Phase One scheme to determine whether there would be new or different significant adverse effects on local communities.

6.2.3 Potential impacts relevant to the community assessment fall broadly within the following categories:

- Demolition/construction, direct loss of land and impacts on property; and
- Intrusion/disturbance to communities and community facilities caused by other environmental impacts.

6.2.4 The study area includes receptors or resources that could be affected by a combination of significant residual effects, such as noise, vibration, construction dust, poor air quality and visual intrusion. In addition, the study area has regard to the proposed routeing of construction traffic and takes account of catchment areas for community facilities which could be affected where crossed by the Proposed Development. Overall, the study area is taken as the area of land which encompasses the likely significant effects of the Proposed Development.

6.2.5 The study area includes the communities of Water Orton, Castle Vale and Bromford each of which is a distinct residential settlement served by a range of local facilities. Within the 2013 ES, Water Orton is within CFA 19, Bromford and Castle Vale are located within CFA 25.

6.2.6 The key design change relevant to the community assessment is the extension of Bromford tunnel by over 3km. This influences the construction impacts, including the temporary and permanent requirement for land, affecting direct impacts on property and community facilities and indirect impacts associated with changes to amenity of residents and users of community facilities.

6.3 Environmental Baseline

Existing baseline

6.3.1 The study area within the 2013 ES, as amended, includes the area of land required temporarily and permanently for the construction and operation of the Phase One scheme. The baseline section of this report provides an update to that overview provided in the 2013 ES, as amended.

6.3.2 Baseline data on community resources was collated up to 500m from the centre line of the Proposed Development, and, additionally, up to 250m from the boundary of the land required for construction. Where there has been a change from the 2013 ES, as amended, this is identified in the baseline information.

Water Orton

6.3.3 Water Orton is located to the north and west of the Proposed Development, bounded to the south by the M6 and the east by the M42 and M6 Toll. The village has a good range of facilities including a small parade of shops, a doctor's surgery, a library, several community halls, two churches and a primary school.

6.3.4 There are also a number of public open spaces and recreational facilities on the south side of Water Orton, including Water Orton Green at Attleboro Lane, Water Orton Bowls Club, Water Orton and District Tennis Club and Vicarage Lane playing field, all on the southern edge of the settlement. These spaces lie outside the study area but serve the local community.

6.3.5 Properties and facilities on the south side of the village at Vicarage Lane and residential properties at Attleboro Lane are included within the study area and some fall wholly or partly within the boundary of land required for the construction and operation of the Proposed Development.

6.3.6 Further to the 2017 Act, Water Orton Primary School has been relocated from a site off Vicarage Lane to a site off Plank Lane, Water Orton. It was opened in September 2019. There is also a day nursery that operates from the new Water Orton School location. The day nursery is called The Tree House of Water Orton.

6.3.7 Twisted Oak Stables is located to the east of Plank Lane on the western edge of Water Orton. As well as providing stables and a place for riding opportunities, there is also a residential property at the site.

Castle Vale

6.3.8 Castle Vale is a residential community located approximately six miles north east of Birmingham city centre within the Castle Vale Ward of Birmingham City Council. It is located between Erdington, Minworth and Castle Bromwich, to the north of the intermediate shaft which forms part of the Proposed Development.

6.3.9 Castle Vale provides a wide range of facilities to serve the local neighbourhood, and a number of facilities to the south of the Castle Vale estate will be in close proximity to the Proposed Development.

6.3.10 Park Hall nature reserve, to the south of the Castle Vale estate and north of the M6, is within an area of land required to construct the Proposed Development. The nature reserve comprises floodplain grassland, wetlands and pools along the former route of the River Tame. There are also areas of ancient woodlands and other habitats within the south of the site. Park Hall nature reserve is an important local resource and is now in possession of HS2 Ltd pursuant to the powers granted by the 2017 Act.

6.3.11 Blenheim Way public open space is located to the east of Castle Vale estate and provides a neighbourhood equipped area for play (NEAP) and a youth shelter alongside grassed areas and footpaths. Farnborough Road Park is also located to the east of Castle Vale estate. The park offers a wide range of facilities including a local equipped area of play (LEAP), outdoor gym, skate park and seven grassed seasonal football pitches. The park is well used by the local community, particularly during the summer.

6.3.12 A number of residential properties on Cadbury Drive and Blenheim Way are within the study area, but outside of the areas of land required to construct and operate the Proposed Development. The properties comprise both terraced and semi-detached properties within a suburban estate setting.

6.3.13 Within the residential area of Castle Vale, the Berwood Court Care Home is within the study area and will be within close proximity of works associated with the Proposed Development.

6.3.14 There is a gypsy and traveller site within the study area, located to the south of the Castle Vale estate, within the Castle Bromwich Business Park on Tameside Drive. The site is owned by BCC, and provides a total of 15 transit pitches,

although it is understood to be currently occupied by a small number of permanent occupants.

Bromford

6.3.15 Bromford provides a range of local facilities that serve the Firs and Bromford residential area. The only community facility within the study area is the Bromford Bridge North East public open space.

Future environmental baseline

Construction

6.3.16 No committed developments have been identified in this study area that will materially affect the future baseline conditions during construction.

Operation

6.3.17 No committed developments have been identified in this study area that will materially affect the future baseline conditions during operation for the community.

6.4 Effects arising during construction

Avoidance and mitigation measures

6.4.1 The EMRs include a range of provisions that will help mitigate the community effects associated with the construction of the Proposed Development, including:

- implementation of a community engagement framework to provide appropriate information and resolve community issues;
- sensitive layout of construction sites to minimise nuisance;
- monitoring and management of flood risk and other extreme weather events, where reasonably practicable, that may affect community resources during construction; 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.

Assessment of impacts and effects

Residential properties

6.4.2 The construction of the Phase One scheme required the demolition of nine residential properties on the south side of Water Orton at Attleboro Lane. The

loss of these properties was assessed in the 2013 ES, as amended, as giving rise to a moderate adverse effect, which is significant. The Proposed Development also requires the demolition of these properties. Therefore, this significant effect remains unchanged.

6.4.3 There are seven residential properties located to the north of the Proposed Development on Attleboro Lane. The 2013 ES, as amended, reported that construction works to the south of Water Orton will generate a combination of significant noise and visual effects on the occupiers of these seven residential properties. These works were expected to take approximately three years to complete, and the combination of these significant effects during this time will give rise to a major adverse and significant amenity effect. During construction, the Proposed Development is also anticipated to generate significant visual effects and significant noise effects, consistent with effects of the Phase One scheme, reported in the 2013 ES, as amended, affecting seven properties in Attleboro Lane and therefore this significant effect remains unchanged.

6.4.4 Approximately ten residential properties in the south-eastern extent of Blenheim Way will be within close proximity to construction activity in both Farnborough Road Park and Castle Bromwich Business Park. The 2013 ES, as amended, reported that the combination of noise and visual effects will result in a major adverse effect on the amenity of residents, which is significant. Although, significant noise effects during the day and night are expected to remain as a result of the Proposed Development, no significant visual effects are likely as the Proposed Development will be hidden from view. See Table 12.5.1 in Section 12 for further detail. Therefore, the significant in-combination effect is no longer anticipated on the amenity of residents, so is removed at these properties.

6.4.5 The 2013 ES, as amended, reported that approximately eight residential properties on Cadbury Drive will experience a combination of significant night-time noise effects and significant visual effects from construction activity at Castle Bromwich Business Park. Significant noise effects are expected to remain, consistent with effects reported for the Phase One scheme, as a result of the Proposed Development. However, no significant visual effects are expected as a result of the Proposed Development. Therefore, the significant in-combination effect is no longer anticipated on the amenity of residents, so is removed at these properties.

6.4.6 The 2013 ES, as amended, reported that the gypsies and travellers located at a site on Tameside Drive within the Castle Bromwich Business Park will be temporarily impacted by nearby construction activities. It was reported that the combination of visual and HGV traffic effects resulted in a major adverse effect on the amenity of the residents for approximately five years, which is significant.

HGV traffic effects are predicted to remain as a result of the Proposed Development; however, no significant visual effects are expected as a result of the Proposed Development. Therefore, the significant in-combination effect is no longer anticipated on the amenity of residents, so is removed.

6.4.7 The 2013 ES, as amended, reported that the disruption to accessibility as a result of Tameside Drive being used as a construction traffic route and the presence of visual barriers, from two construction compounds, a temporary stockpile of earthworks and temporary fencing, around the gypsy and traveller would result in a major adverse isolation effect on the residents, which is significant. No significant visual effects are expected as a result of the Proposed Development as the level of construction activity near to the boundary of the gypsy and traveller site is reduced. Therefore, the significant isolation effect is no longer anticipated on the residents, so is removed.

Community infrastructure

6.4.8 Water Orton Primary School and The Tree House of Water Orton were located approximately 200m from the centreline of the Phase One scheme. Part of the playing fields and grounds belonging to the Water Orton Primary School did previously lie within the boundary of land required permanently for the construction and operation of the Phase One scheme. The effects of the loss of land on the school community were assessed as minor adverse and not significant.

6.4.9 Since the submission of the 2013 ES, as amended, Water Orton Primary School and The Tree House of Water Orton nursery has moved to a new location off Plank Lane. As a result of this relocation, land required for the construction of the Proposed Development is no longer utilised by Water Orton Primary School. As such, no effects are anticipated on the school.

6.4.10 Berwood Court Care Home is located less than 100m north of the construction boundary of the Proposed Development at Castle Bromwich Business Park. The 2013 ES, as amended, reported that significant daytime noise effects and visual effects were expected. A major adverse effect on amenity of the residents of the care home was reported, which is significant.

6.4.11 As a result of the Proposed Development, significant daytime noise effects are predicted, consistent with effects of the Phase One scheme, reported in the 2013 ES, as amended. However, significant visual effects are no longer anticipated as a result of the construction of the Proposed Development as intervening vegetation to be retained will filter and largely obscure views of construction activities. Therefore, the noise and visual effects no longer combine. As a result of the Proposed Development, no in-combination effects on the amenity of

residents at Berwood Court Care Home are anticipated so the significant effect reported in the 2013 ES, as amended, is removed.

Open space and recreational PRoW

6.4.12 The construction of the Phase One scheme temporarily required a large part of Park Hall nature reserve. It was reported that the nature reserve will be closed to visitors throughout the construction period and reopened following the completion of construction works. As Park Hall nature reserve is an important local resource, providing both a role in education as well as recreational opportunities, the 2013 ES, as amended, reported that closure of the nature reserve would have a major adverse significant effect. During construction of the Proposed Development, the nature reserve will still be closed to visitors and reopened following the completing of construction works. The effects therefore remain the same as those reported in the 2013 ES, as amended.

6.4.13 Farnborough Road Park provides large areas of parkland in the south-eastern extent of Castle Vale, providing 5.2ha of public open space with some formal recreational facilities such as football pitches and picnic areas. The 2013 ES, as amended, did not report any significant effects associated with the requirement for land affecting the park. The 2013 ES, as amended, reported major significant amenity effects on the users of the park due to visual effects and HGV traffic effects. Due to changes in construction activity resulting from the Proposed Development, no significant visual effects or HGV traffic effects are predicted. Therefore, no significant effects on the amenity of users of Farnborough Road Park are expected to arise so the significant effect reported in the 2013 ES, as amended, is removed.

Other mitigation and residual effects

6.4.14 No mitigation measures, additional to those identified in the 2013 ES, as amended, and CoCP, are identified and therefore effects are as described above.

Cumulative effects

6.4.15 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

6.5 Effects arising during operation

Avoidance and mitigation measures

6.5.1 No avoidance or mitigation measures, additional to those reported in the 2013 ES, as amended, and CoCP, are identified.

Assessment of impacts and effects

6.5.2 The 2013 ES, as amended, did not report any significant effects arising from operation of the Phase One scheme. No significant effects are expected arising from the operation of the Proposed Development.

Other mitigation and residual effects

6.5.3 No other mitigation measures are proposed and therefore effects are as described above.

Cumulative effects

6.5.4 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

6.6 Summary

6.6.1 New or different significant adverse effects are expected to result from the Proposed Development, as compared with the Phase One scheme.

6.6.2 The following effects are no longer considered to be significant, as a result of the Proposed Development, as compared to the effects of the Phase One scheme:

- In-combination effects on the amenity of residents of the approximately 10 residential properties on Blenheim Way;
- In-combination effects on the amenity of residents of the eight resident properties on Cadbury Drive;
- In-combination effects on the amenity effects on the residents of the Gypsy and Traveller site at Tameside Drive;
- Isolation effects on the residents of the gypsy and traveller site at Tameside Drive;
- In-combination effects on the amenity of residents at Berwood Court Care Home; and
- In-combination effects on the amenity of the users of Farnborough Road Park.

6.6.3 Within the study area, Water Orton Primary School has been relocated and therefore the adverse significant effect affecting this community resource has also been removed.

6.6.4 There would be a reduction in significant community effects as a result of the Proposed Development, compared with the Phase One scheme as reported in the 2013 ES, as amended, because in-combination effects on the amenity of

residents in some locations are no longer considered to be significant, due to reduced construction activity at Castle Bromwich Business Park. Additionally, the isolation effects on residents at Tameside Drive during construction are no longer considered to be significant, also due to reduced construction activity at Castle Bromwich Business Park.

7 Climate Change

7.1 Introduction

7.1.1 It has now been established that as a result of rising concentrations of carbon dioxide (CO_2), and other greenhouse gases in the atmosphere, a degree of climate change is inevitable and is expected to have significant implications for infrastructure assets in future, particularly those with long operational lifetimes. This makes them sensitive, not only to the existing climate at the time of their construction, but also to climate variations over the decades of their use. In addition, legislative requirements have been set by the UK government to reduce national greenhouse gas (GHG) emissions to net-zero by 2050.

7.1.2 Whilst an assessment of the impact of climate change on the Phase One scheme's resilience was undertaken within the 2013 ES, as amended, this was prior to the EIA Regulations which came into force during 2017, as set out in section 1, and prior to the current accepted industry approach to assessment. The EIA Regulations state that environmental impact assessments should include "the impact of the project on climate (for example the nature and magnitude of greenhouse gas emissions) and the vulnerability of the project to climate change". Both elements have been applied to this assessment, together with the current accepted industry approach to assessment. Further detail regarding the approach is set out below.

7.2 Scope assumptions and limitations

7.2.1 This section presents the outcomes of the screening assessment for the climate change related environmental factor presented in two separate aspects:

- Impacts on climate – effects of GHG emission on climate change arising from the Proposed Development; and
- Resilience of the Proposed Development to climate change – the resilience of the Bromford tunnel extension to climate change and impacts relevant to adaptation.

Impacts on climate

7.2.2 The climate change assessment for the construction phase includes construction-related activities that occur within the Proposed Development site. Emissions also include those associated with activities supporting construction, some of which occur outside the Proposed Development site, for example GHG emissions from construction related transport and GHG emissions associated with production, manufacture and refining of construction materials.

7.2.3 The impact that the Proposed Development will have on GHG emissions from the operation of HS2 has also been reviewed as part of this screening exercise. None of the amendments associated with the Proposed Development were identified to have material impacts on operational GHG emissions. Only the maintenance and replacement of the materials and assets themselves will be assessed as part of the operational GHG impact calculations.

Resilience of the Proposed Development to climate change

7.2.4 The spatial scope for considering the resilience of the Proposed Development to climate change includes all areas of land required to be permanently acquired and considers the constructed elements of the Proposed Development being implemented within the land required to be permanently acquired.

7.2.5 The impact of climate change on the construction phase was considered in the 2013 ES, as amended, where similar risks would be present if the Proposed Development were to be carried out. The construction risks identified within Volume 5 (Appendix: CL-003-000) of the 2013 ES, as amended, relate to the potential for extreme weather events such as heavy rain, hot weather events and high winds to affect or disrupt construction activities. Account has been taken on the measures identified in the CoCP, and it is considered that, as with the Phase One scheme, if these measures are implemented there will be no significant effects during the construction phase of the Proposed Development. In addition, given the relatively short length of the construction period, it is anticipated that any changes to long-term, seasonal averages due to climate change will not be significant during the construction period. The focus of the assessment will be on the resilience of the operational infrastructure of the Proposed Development to climate change.

7.2.6 The operational climate change risk assessment considers a twenty year period up to 2099 (between 2080-2099) as the timeline for analysis. The timeline is informed by the long lifespan of the assets within the Proposed Development, with the tunnels having a lifespan of 120 years. The UK Climate Projections 2018 (UKCP18)[12] are used to set the future baseline as these are the most up to date projections and best practice. The furthest projections available are for the 2090s time period as chosen in the 2013 ES, as amended. Where assets have a shorter lifespan (e.g. street lighting) this has been taken into account in the assessment by assessing the potential climate projections at the relevant years depending on their life span. The UKCP18 projections have been used instead of UKCP09 projections as they are the most up to date assessment of climate change for the UK.

[12] Met Office (2019), UKCP 18: Regional (12km) and Local (2.2km) Projections [online] available at: https://www.metoffice.gov.uk/research/approach/collaboration/ukcp/high-res-projections (last accessed July 2020)

7.2.7 The significance criteria used to inform this screening assessment is based on that in the Volume 5 (Appendix CL-003-000) of the 2013 ES, as amended. Technical Appendices, Resilience to impacts from climatic conditions Climate.

7.3 Environmental Baseline

Existing baseline

7.3.1 The current accepted industry methodology for delivery of climate resilience assessments includes establishing a present-day or historic baseline, therefore an historic climate baseline is included in this section.

Impacts on climate

7.3.2 The baseline for climate change mitigation is the existing carbon emissions from transportation and construction in the UK:

- In 2018, UK net carbon dioxide (CO_2) emissions were estimated at 366 million tonnes, a decrease of 2% in comparison to 2017 levels. In 2018 the transport sector accounted for 28% of UK GHG emissions; this is a 1% decrease in total emissions in comparison to 2017[13].
- The UK construction industry is the largest consumer of natural resources with an average of over 400 million tonnes of material consumed every year. This is estimated to account for approximately 10% of the total UK carbon emissions[14].

Resilience of the Proposed Development to climate change

7.3.3 The baseline for this assessment is the historic weather observed in the area.

7.3.4 The Met Office holds historical regional climate information, in which the Bromford tunnel area is included in the Midlands region[15]. High-level climate observations for the Midlands over a 30-year averaging period between 1981-2010 are presented in Table 7.3.1.

[13] Department for Business, Energy and Industrial Strategy (2020): 2018 UK Greenhouse Gas Emissions, Final Figures [online] available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/863325/2018-final-emissions-statistics-summary.pdf (last accessed July 2020).
[14] Institute of Civil Engineers (ICE) (2014): Energy Briefing Sheet: Embodied Energy and Carbon [online] available at: https://www.ice.org.uk/ICEDevelopmentWebPortal/media/Documents/Disciplines%20and%20Resources/Briefing%20Sheet/Embodied_Energy_and_Carbon.pdf (last accessed July 2020).
[15] The Met Office (2016) Midlands: Climate [online] available at: https://www.metoffice.gov.uk/binaries/content/assets/metofficegovuk/pdf/weather/learn-about/uk-past-events/regional-climates/midlands_-climate---met-office.pdf (last accessed July 2020)

Table 7.3.1 Historic climate baseline for the Midlands (1981 - 2010)

Climatic conditions	Climate observations
Temperature	Mean daily minimum temperatures ranged from 0°C to 1.5°C in winter, whilst summer daily maximum temperatures were in the region of 22°C.
Rainfall	Atlantic depressions or convection are the source of the majority of rain in the Midlands, particularly in autumn and winter where Atlantic Lows are more vigorous. Annual rainfall in the Midlands averages at 800mm. Monthly rainfall is variable but is highest in the winter months. The number of days with rainfall totals greater than 1mm is 30 to 35 days in winter, dropping to an average of 30 days in summer.
Wind	The Midlands area is one of the more sheltered parts of the UK. The strongest winds are associated with the passage of deep areas of low pressure close to or across the UK. The frequency and strength of these depressions is greatest in the winter half of the year when mean speeds are approximately 9 knots and mean wind gusts at 55 knots.
Sunshine	Average annual sunshine totals were between 1400 and 1600 hours.
Air Frost	The average number of days with air frost varies from 40 to 60 days per year.

Source: Met Office Regional Climate Data

Future environmental baseline

Construction – Impacts on Climate

7.3.5 There are no current government projections for construction emissions however, all future construction must support the UK Government's Net-Zero trajectory. As part of the Climate Change Act legally binding carbon budgets have been set capping the amount of GHG emitted in the UK over a 5-year period, as set out in Table 7.3.2 below. The 6th carbon budget (2033-2037), was published at the end of 2020 and is the first budget to take into account the updated commitment to net zero required under the Climate Change Act.

Table 7.3.2 UK Carbon Budget

Carbon Budget	Carbon Budget Level	Reduction Below 1990 Levels
3rd carbon budget (2018- 2022)	2,544MtCO_2e	37% by 2020
4th carbon budget (2023- 2027)	1,950MtCO_2e	51% by 2025
5th carbon budget (2028- 2032)	1,725MtCO_2e	57% by 2030
6th carbon budget (2033- 2037)	965MtCO_2e	78% by 2035

Construction – Resilience of the Proposed Development to climate change

7.3.6 The climate is projected to have more extreme weather events, hotter summers and wetter winters as presented in Table 7.3.2 potentially affecting the construction periods as periods of time may become unworkable. According to the Office for National Statistics the construction sector shrank 3% in February 2018 compared to the same month in 2017 due to the extreme cold weather event known as the "Beast from the East".

7.3.7 Extreme hot or cold conditions may require additional specialised equipment resistive to such conditions. Better site management will be required to ensure that materials are stored correctly in case of extreme weather events.

Operation – Impacts on Climate

7.3.8 The transport sector is a key driver in the trend of projected UK emissions, and therefore the future baseline of GHG emissions in the UK will be impacted by all transport construction projects including Phase One and the Proposed Development. The projections from the Department for Business, Energy & Industrial Strategy (referred to as the BEIS projections) show a decline in transport emissions to 2035 (emissions show a decline of 15% to 2025 from 2016 levels).

Operation – Resilience of the Proposed Development to climate change

7.3.9 The UK Climate Projections developed by the Met Office Hadley Centre include regional climate projection data, for which Birmingham Area is included in the West Midlands region. The East of England is projected (under a range of emissions scenarios modelled in UKCP18) to experience hotter and drier summers, and warmer and wetter winters (See Table 7.3.2).

7.3.10 For this assessment, a range of climate projections data for the 2090s (2080-2099) under Representative Concentration Pathway (RCP) 4.5 to 8.5[16]. The 10th, 50th and 90th percentile changes have also been presented. As mentioned in section 7.2.6 UKCP18 has been used rather than UKCP09 as these are the most up-to-date climate projections.

7.3.11 Projected changes in key climate variables under the RCP 4.5 to 8.5 emissions scenario, for the 2080s, are summarised in Table 7.3.3.

[16] RCP: Representative Concentration Pathways. RCPs are the new scenarios developed by the Intergovernmental Panel on Climate Change (IPCC) and used by the UKCP18 climate projections. RCPs are based on the projected concentration of greenhouse gases in the atmosphere in 2100, e.g. RCP 8.5 is a radiative forcing of 8.5 in 2100. These replace the previous Low, Medium and High scenarios. There are 4 RCPs in UKCP18 (2.6, 4.5, 6.0 and 8.5). These do not directly map onto the Low, Medium, High scenarios used previously.

Table 7.3.3 Future climate projections for the 2090s (Range given from RCP 4.5 to RCP 8.5 scenario at 10th, 50th and 90th percentile changes)

Climatic conditions	Climate observations
Temperature	The average summer temperature is projected to increase from 1.4° C under the 10th percentile, 3.1° C under the 50th percentile and 5.1° C under the 90th percentile at the lower projection boundary RCP 4.5. With RCP 8.5 projected to increase from 2.6° C under the 10th percentile, 5.2° C under the 50th percentile and 7.8° C under the 90th percentile. The average winter temperature is projected to increase from 0.7° C under the 10th percentile, 2.1° C under the 50th percentile and 3.5° C under the 90th percentile at the lower projection boundary RCP 4.5. With RCP 8.5 projected to increase from 1.5° C under the 10th percentile, 3.5° C under the 50th percentile and 5.7° C under the 90th percentile.
Rainfall	The average summer rainfall is projected to decrease by 44% under the 10th percentile, 22% under the 50th percentile and 0% under the 90th percentile at the lower projection boundary RCP 4.5. With RCP 8.5 projected to decrease by 69% under the 10th percentile, 35% under the 50th percentile and 2% under the 90th percentile. The average winter rainfall is projected to decrease by 4% under the 10th percentile, increase by 12% under the 50th percentile and 29% under the 90th percentile at the lower projection boundary RCP 4.5. With RCP 8.5 projected to decrease by 1% under the 10th percentile, increase by 20% under the 50th percentile and 47% under the 90th percentile.
Wind	Climate projections for wind are more uncertain than those for temperature and precipitation, due to inherent difficulty in modelling future wind conditions. However, overall an increase in extreme weather, including wind, is projected.

7.4 Effects arising during construction

Avoidance and mitigation measures

Impacts on climate

7.4.1 The Proposed Development has been value engineered to reduce the use materials where possible resulting in less embodied carbon.

Assessment of impacts and effects

Impacts on climate

7.4.2 The carbon emissions for Phase One, using the central estimate of the 2015 SES3 and AP4 ES were assessed route-wide resulting in an estimated footprint of 6,125,000 tCO_2e[17]. Some of the largest contributors to the route-wide embedded

[17] HS2, Supplementary Environmental Statement 3 and Additional Provision 4 (2015): SES 3 and AP 4 Volume 3: Route-wide effects [online] available at: (last accessed November 2020).

carbon footprint were found to be the construction of tunnels including tunnel boring machines (TBMs) and dive-unders (1,540,000 tCO_2e in total).

7.4.3 The 2013 ES, as amended, reported construction carbon emissions at a route-wide level. In order to estimate the impact of the Proposed Development it was necessary to use a more granular carbon emissions calculation which could be broken out by asset. The carbon footprint calculated as a baseline for the Lot N1 Main Works Civils Contract was used as it includes an estimate of the carbon footprint per asset type based on the Phase One scheme design for the N1 Lot where the Bromford tunnel is located[18]. This calculation was based on the Phase One scheme requiring the assets set out in Table 7.4.1 and was calculated to a total carbon footprint of approximately 141,700 tCO_2e. The same life cycle stages have been included within the assessment as stated within the 2013 ES, as amended.

Table 7.4.1 Carbon estimates (tCO2e) for Phase One assets and Proposed Development assets

Asset Name	Phase One Scheme Design Carbon (rounded to nearest 100 tCO_2e)	Proposed Development Carbon (rounded to nearest 100 tCO_2e)
Water Orton Road embankment (including Parkhall Wood embankment)	900	Not required
Water Orton south retaining wall (sub-asset of Water Orton cutting)	1,900	Not required
River Tame viaduct	16,500	Not required
Park Hall retained fill	6,200	Not required
Langley Hill embankment	11,300	Not required
Plants Brook underbridge	12,500	Not required
Dunlop carrier channel culvert	400	Not required
Castle Bromwich retained cut	32,900	Not required
River Tame realignment	600	Not required
Water Orton road overbridge	1,700	Not required
Bromford tunnel including cross passages and shaft	2.8km - 56,700	5.8km – 121,200
Total:	**141,700**	**121,200**

7.4.4 The Proposed Development would result in a saving of 20,500 tCO_2e reducing the effects of the Phase One scheme due to removing the need for the assets listed above and the extended 5.8km Bromford tunnel resulting in an estimated 121,200 tCO_2e.

[18] Note that the asset-level footprint is based on initial high-level design information and is not the final designed asset footprint.

Other mitigation and residual effects

7.4.5 No other mitigation has been proposed and therefore effects are as described above.

Cumulative effects

7.4.6 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

7.5 Effects arising during operation

Avoidance and mitigation measures

Resilience of the Proposed Development to climate change

7.5.1 The high level climate risk assessment undertaken on the original Phase One scheme design in Volume 5 (Appendix: CL-003-000) of the 2013 ES, as amended, stated that before resilience measures were considered, two high risks posed by climate change were identified; potential flooding of track, cuttings and tunnels, and overheating of tunnels. Overheating within the tunnels can impact on the performance and safety of the railway where the rails can expand, and the build-up of forces cause the track to distort or buckle.

7.5.2 Flooding of the track, cuttings and within tunnels is a potentially significant risk that could affect safety, cost, journey times and public perception. During the interim preliminary design stage, a comprehensive flood risk assessment (FRA) has been carried out in consultation with the Environment Agency for each community forum area to assess the vulnerability of infrastructure and assets associated with the Proposed Development to all possible types of flooding.

7.5.3 To address the potential increase in flood risk, all operational infrastructure and assets associated with the Proposed Development will be protected by a 1m freeboard above the 1 in 1,000 year (0.1%) annual probability of flooding. Replacement flood storage areas are to be implemented to mitigate the potential for a significant increase in flood risk to and from sites along the Proposed Development. Management measures, such as flood risk management plans will also be required in addition to avoidance measures included in the design. on the assumption that groundwater levels are 1 metre below ground surface. Railway drainage will accommodate for storms up to the 1 in 100 year (1%) annual probability of flooding (including +30% for climate change allowance). This will allow for an expected increase in the intensity of rainfall events and will require regular maintenance to ensure drainage systems are not blocked by debris during heavy storms.

7.5.4 The design change to the extended Bromford tunnel removes the need for the assets listed in Table 7.4.1 lowering the risk of additional climate effects. The original climate risks identified above as flooding and overheating remain the primary impacts to the updated Bromford tunnel extension.

7.5.5 However, the Proposed Development has been designed in line with the EA Flood risk assessments: climate change allowances (2016) guidance which includes a 50% increase in flows for this area. This is a 20% increase in flow capacity compared with that stated in the 2013 ES, as amended, and paragraph 7.5.3. This increase in flow capacity has been applied to the design of the flood replacement storage areas as well as all infrastructure drainage. Furthermore, in the proposed the design with the Bromford tunnel extension and the east portal moving further east, the flood risk is lower (according to the FRA undertaken) in turn further reducing the potential risks of increased flooding due to climate change. Additional details can be found in section 18 of this report.

7.5.6 To address the potential risk of overheating within the proposed tunnel extension, intermediate jet fans have been designed across the tunnel to be used during track congestion. The high-speed movement of the train through the tunnel will provide the majority of the standard ventilation required due to the forced ventilation as the train moves through. The design of the Proposed Development is based on the projections set out in UKCP18.

Assessment of impacts and effects

Resilience of the Proposed Development to climate change

7.5.7 With the above resilience measures in place the risks to track, cuttings and tunnels from flooding are considered to be low for the Phase One Bromford tunnel design. The design changes in the Proposed Development are considered to further reduce the potential of flooding, further lowering the risk.

7.5.8 The risk of overheating has been reduced from high for the Phase One scheme to low risk for the Proposed Development due to the resilience measures adopted to address them during interim preliminary design stage. Resilience measures considered at interim preliminary design stage include the provision of adequate space within tunnels and ventilation shafts for anticipated future cooling and ventilation requirements.

7.5.9 The resilience measures designed into the Proposed Development to mitigate potential increased overheating risks due to the tunnel extension have resulted in the risk being low.

Other mitigation and residual effects

7.5.10 No other mitigation has been proposed and therefore effects are as described above.

Cumulative effects

7.5.11 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

7.6 Summary

7.6.1 The Proposed Development would result in a reduction in carbon emissions by an estimated 20,500 tonnes (measured using the carbon dioxide equivalent), therefore a reduction in effects is expected compared to the Phase One scheme. In terms of resilience to climate change, there is a risk to overheating within the tunnel extension, however this risk would be mitigated down to a low risk by the ventilation systems in the tunnel design. In addition, there is a likely benefit due to the reduction in flood risk as a result of the Proposed Development. In summary, the change in design would not give rise to climate change effects that are greater than those reported in the 2013 ES, as amended, and would therefore not give rise to any new or different significant adverse effects when compared with the Phase One scheme.

8 Cultural Heritage

8.1 Introduction

8.1.1 The environmental baseline relevant to the Cultural Heritage assessment is described below. Any new or different likely significant adverse environmental effects as a result of the Proposed Development are then identified, compared to those reported in the 2013 ES, as amended.

8.2 Scope assumptions and limitations

8.2.1 The scope and methodology of the cultural heritage assessment are provided in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and SMR Addendum (Volume 5: Appendix CT-001-000/2) of the 2013 ES, as amended. The impact assessment presented in this section of the EIA screening report follows the same assessment methodology. The study area for this assessment is the land required for the Proposed Development plus 50m.

8.2.2 The assessment focuses on the extent to which the Proposed Development will affect designated and non-designated heritage assets. Key changes compared to the Phase One scheme that are relevant to the Cultural Heritage assessment include:

- extension of Bromford tunnel from Castle Bromwich Business Park to the Water Orton area, including the associated construction and excavation activities required for the Bromford tunnel east portal and associated infrastructure located southwest of Water Orton;
- replacement of Bromford tunnel east portal and other ancillary infrastructure with Bromford tunnel intermediate shaft at Castle Bromwich Business Park; and
- Installation of temporary and permanent access tracks within Park Hall nature reserve.

8.3 Environmental Baseline

Existing baseline

Designated heritage assets

8.3.1 Two separate lengths of ancient woodland at Parkhall Wood (CBB007 and CBB008[19]) are located partially or wholly within the land required, temporarily or permanently, for the construction of the Phase One scheme (Volume 5: Maps

[19] 2013 ES, as amended, cultural heritage asset unique reference number.

CH-02-154b to CH-02-157a of the 2013 ES, as amended) and have been considered in respect of the Proposed Development.

8.3.2 The following designated assets are located within the study area (see Volume 2, CFA 25 Map Book and Volume 5: Maps CH-02-154b to CH-02-157a of the 2013 ES, as amended):

- two scheduled monuments: a medieval bridge at Water Orton (CBB004) (also a listed building) and the remains of a motte and bailey castle at Castle Bromwich (CBB044);
- four Grade I listed buildings: Castle Bromwich Hall (CBB046), bakehouse (CBB043) at Castle Bromwich Hall, and the church of St Mary and St Margaret, Castle Bromwich (CBB049), Church of St Peter and St Paul, Coleshill (COL056);
- three Grade II* listed buildings: stable block (CBB041) at Castle Bromwich Hall, pigeon house (CBB040) at Castle Bromwich Hall, and gatepiers (CBB045) at Castle Bromwich Hall;
- a Grade II* registered Park and Garden, Castle Bromwich Hall (CBB035);
- twenty four Grade II listed buildings of which three are within Castle Bromwich Hall (CBB046), three are within Castle Bromwich Conservation Area (CBB039, CBB038 and CBB037) and three of which are in the Water Orton Conservation Area (COL070);
- the Castle Bromwich Conservation Area (CBB076); and
- the Water Orton Conservation Area (COL078).

Non-designated heritage assets

8.3.3 There are no non-designated assets of high and moderate value that lie wholly or partially within the land required, temporarily and permanently, for the construction of the Phase One scheme or the Proposed Development.

8.3.4 The following identified non-designated assets of low value lie wholly or partially within the land required, temporarily and permanently, for the construction of the Phase One scheme and have been considered in respect of the Proposed Development:

- thirty one heritage assets which are associated with Park Hall Manor, including the site of the Great House (CBB020), walled garden (CBB018), the deer park (CBB012), dovecote (CBB014), bridge (CBB015), possible leats or former watercourses (CBB010, CBB088, CBB089, CBB090, CBB092, CBB093, CBB095, CBB096 and CBB097), outbuildings (CBB022), a platform (CBB086) and two trackways (CBB033 and CBB091). Assets also include ridge and furrow at Park Hall (CBB021, CBB029, CBB031, CBB082, CBB083, CBB084, CBB087, and CBB094), saw pits (CBB011 and CBB025), the former river

channel to River Tame (CBB081), possible water meadows and medieval fields (CBB003 and CBB064), medieval fields (CBB005) and the site of a prehistoric burnt mound (CBB032);
- two areas of ancient woodland identified as being of historic interest: Langley Hill Wood (CBB030) and Parkhill Wood (previously known as Spring Hill Wood) (CBB023).
- four archaeological assets associated with medieval and post medieval agricultural practices comprising two sets of cropmarks indicating possible field systems (COL092 and COL093) and two areas of ridge and furrow (COL042 and COL044);
- a circular ditch, within field south of Water Orton (COL045); and
- Water Orton Medieval Settlement (COL037).

8.3.5 All non-designated heritage assets within 250m of the land required, temporarily and permanently, for the construction of the Phase One scheme are listed in the amended, gazetteer, Volume 5: Appendix CH-002-025, and identified on Volume 5: Maps CH-01-156 to CH-01-160a, of the 2013 ES, as amended.

8.3.6 The settings of built heritage assets have also been considered, for example: the locally listed building, Dunlop Ltd base stores (main fort) building (CBB063) and Attleboro Farm and Barns (COL087).

Future environmental baseline

Construction

8.3.7 The future baseline for construction remains unchanged from that reported in the 2013 ES, as amended. Committed developments identified in Section 2 of this report would not alter baseline information in respect of cultural heritage.

Operation

8.3.8 The future baseline for operation remains unchanged from that reported in the 2013 ES, as amended. Committed developments identified in Section 2 of this report would not alter baseline information.

8.4 Effects arising during construction

Avoidance and mitigation measures

8.4.1 There are no specific measures included as part of the Proposed Development to avoid or reduce impacts to cultural heritage. The assessment assumes implementation of appropriate mitigation measures described within the EMRs, CoCP and Heritage Memorandum. These include;

- provision by the nominated undertaker to its contractors of locations and descriptions of all known cultural heritage assets within and adjacent to construction works, including restrictions to construction methods to protect cultural heritage assets, where these have been identified in the ES, Additional Provisions, undertakings and assurances, subsequent consultation and through the development of the detailed design;
- an historic environment investigation programme detailing the implementation of archaeological and heritage investigation and recording works prior to and during construction;
- the nominated undertaker will ensure that the historic environment works are properly programmed by the lead contractor;
- the nominated undertaker will require its lead contractors to monitor compliance against the programme of historic environment investigation and to record works using appropriately qualified environmental management staff;
- during all stages, the nominated undertaker will require its lead contractors to facilitate archaeological and built heritage specialists undertaking the works as specified as an appropriate mitigation measure (including purposive investigation);
- all archaeological, built heritage and historic landscape intervention, recording, analysis, dissemination and archiving will be undertaken by a suitably qualified and demonstrably experienced organisation; and
- Historic England and the local authorities (and National Trust, Canal & River Trust or Commonwealth War Graves Commission, as appropriate) will be consulted as appropriate through all stages of the implementation of the programme of historic environment works.

Assessment of impacts and effects

Temporary effects

8.4.2 No significant effects were reported in the 2013 ES, as amended, as a result of temporary impacts on the setting of designated or non-designated heritage assets within the study area. This is not expected to change as a result of the Proposed Development.

8.4.3 The 2013 ES, as amended, reported a temporary medium adverse impact and temporary minor adverse effect on Attleboro Farm and Barns (COL087), a non-designated, low value asset, due to the presence of construction and construction compounds. This effect is not significant and is expected to remain as a result of the Proposed Development.

Permanent effects

8.4.4 In relation to the Phase One scheme, archaeological remains associated with the non-designated undated cropmarks of a possible field system south of Water Orton (COL092), an asset of low value, would be removed by construction of embankments and planting. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. This effect remains unchanged as a result of the Proposed Development.

8.4.5 In relation to the Phase One scheme, the non-designated ridge and furrow earthworks south of Water Orton (COL044), an asset of low value, would be removed to enable construction of embankments for the north chord. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. This effect remains unchanged as a result of the Proposed Development.

8.4.6 In relation to the Phase One scheme, archaeological deposits within and associated with the non-designated Park Hall Deer Park (CBB012), an asset of low value, would be partially removed. These deposits would be removed by the construction of the Water Orton cutting, the Park Hall Wood embankment, excavation for flood storage areas, site compounds and haul roads within the Park Hall nature reserve, the River Tame realignment and balancing ponds. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. The Proposed Development will remove the need to construct the Water Orton cutting, the Park Hall Wood embankment, excavate for flood storage areas, construct site compounds and haul roads within the Park Hall nature reserve, realign the River Tame and excavate balancing ponds. This will remove impacts to archaeological deposits within Park Hall Deer Park related to that work. However, as a result of the construction of the new temporary and permanent access track archaeological deposits within Park Hall Deer Park will be partially removed resulting in partial loss of archaeological remains. This would result in a minimal adverse impact and minor adverse effect which is not significant. Therefore, the Proposed Development would remove the significant effects for these assets.

8.4.7 In relation to the Phase One scheme, Parkhall Wood area of ancient woodland (CBB007 and CBB008), an asset of high value, would be affected by partial removal of the south-west portion of the woodland for construction of the Water Orton Road embankment and the Water Orton cutting through the scarp slope. This would constitute a permanent high adverse impact and major adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.8 In relation to the Phase One scheme, the non-designated buried linear assets of low value, visible on aerial photographs within the site of the former Castle Bromwich airfield and military WWII factories (CBB016) would have the southern part removed by the excavation of balancing ponds to the north of the existing Birmingham and Derby line. This would constitute a permanent moderate adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.9 In relation to the Phase One scheme, the non-designated archaeological remains of the 17th century Great House of Park Hall (CBB020), an asset of low value, would be wholly removed by construction of the River Tame viaduct, and the River Tame viaduct satellite compound, excavation required for the creation of flood storage areas and the diversion of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.10 In relation to the Phase One scheme, the non-designated extant remains of the walled garden of Park Hall (CBB018), an asset of low value, would be wholly removed by construction of the River Tame viaduct, the River Tame viaduct satellite compound, excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.11 In relation to the Phase One scheme, non-designated remains of agricultural outbuildings associated with Park Hall (CBB022), assets of low value, would be wholly removed by construction of the River Tame viaduct, excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.12 The non-designated remains of a bridge (CBB015), an asset of low value, would be wholly removed by excavation required for the creation of replacement floodplain storage areas in Park Hall nature reserve. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.13 In relation to the Phase One scheme, the non-designated site of a dovecote (CBB014), an asset of low value, would be wholly removed by construction of the River Tame viaduct, excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.14 In relation to the Phase One scheme, the non-designated site of a platform identified through lidar analysis located within Park Hill nature reserve (CBB086), an asset of low value, would be wholly removed by construction of the River Tame viaduct and excavation required for the creation of flood storage areas. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.15 In relation to the Phase One scheme, non-designated ridge and furrow within Park Hall nature reserve (CBB087 and CBB094), assets of low value, would be wholly removed by construction of the River Tame viaduct, excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, these assets will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.16 In relation to the Phase One scheme, non-designated areas ridge and furrow within Park Hall nature reserve (CBB021, CBB029, CBB031, CBB082, CBB083 and CBB084), assets of low value, would be wholly removed by construction of the River Tame viaduct, excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. The Proposed Development will remove the need to construct the River Tame viaduct, excavate for flood storage and realign the River Tame, removing impacts to the ridge and furrow related to that work. However, as a result of the construction of the new temporary access track these assets will be partially removed resulting in partial loss of archaeological remains. This would result in a permanent minimal adverse impact and minor adverse effect which is not significant. Therefore, the Proposed Development would remove the significant effects for these assets.

8.4.17 In relation to the Phase One scheme, non-designated medieval fields and drains or water meadows (CBB003 and CBB064) assets of low value, would be wholly removed by excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse

impact and moderate adverse effect, which is significant. The Proposed Development will remove the need to excavate for flood storage areas removing impacts to the medieval fields and drains or water meadows related to that work. However, as a result of the construction of the new temporary access track these assets will be partially removed resulting in partial loss of archaeological remains. This would result in a residual permanent minimal adverse impact and minor adverse effect which is not significant. Therefore, the Proposed Development would remove the significant residual effects for these assets.

8.4.18 In relation to the Phase One scheme non-designated medieval fields (CBB005) an asset of low value, would be wholly removed by excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. The Proposed Development will remove the need to excavate for flood storage areas removing impacts to the medieval fields related to that work. However, as a result of the construction of the new temporary access track this will be partially removed resulting in partial loss of archaeological remains. This would result in a residual permanent minimal adverse impact and minor adverse effect which is not significant. Therefore, the Proposed Development would remove the significant residual effects for this asset.

8.4.19 In relation to the Phase One scheme a number of non-designated areas of ditches, leats, or former water courses (CBB010, CBB088, CBB089, CBB090, CBB092, CBB093, CBB095, CBB096 and CBB097), assets of low value, would be totally removed by construction of the River Tame viaduct, excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.20 In relation to the Phase One scheme, the non-designated former river channel of River Tame (CBB081) an asset of low value, would be removed through excavation for flood compensation, construction of River Tame viaduct, realignment of River Tame and construction of satellite compounds. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.21 In relation to the Phase One scheme, a non-designated trackway (hollow way) at Park Hall (CBB033), an asset of low value, would be removed by excavation

required for the creation of flood storage areas and construction of a haul road to connect the area of construction with Tameside Drive. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.22 In relation to the Phase One scheme a non-designated trackway (CBB091) an asset of low value, would be totally removed by excavation required for the creation of flood storage areas and the realignment of the River Tame. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. The Proposed Development will remove the need to excavate for flood storage areas and realign the River Tame removing impacts to the trackway related to that work. However, as a result of the construction of the new temporary access track this asset will be partially removed resulting in partial loss of archaeological remains. This would result in a residual minimal adverse impact and minor adverse effect which is not significant. Therefore, the Proposed Development would remove the significant residual effects for this asset

8.4.23 In relation to the Phase One scheme, the non-designated Parkhill Wood and woodbank (CBB023), an asset of low value, would be affected by clearance of parts of the woodland to enable the diversion of overhead power lines as an early construction activity. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. A saw pit within Parkhill Wood (CBB025), an asset of low value, would be totally removed by construction activities associated with the diversion of the overhead power lines. As a result of the Proposed Development, these assets will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.24 In relation to the Phase One scheme, the non-designated Langley Wood (CBB030), an asset of low value, would be affected by partial clearance of the woodland as an early construction activity, including the erection of temporary construction fencing. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development, this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.25 In relation to the Phase One scheme, the non-designated site of a prehistoric burnt mound Park Hall (CBB032), an asset of low value, would be totally removed by the River Tame realignment and excavation required for balancing ponds. This would constitute a permanent high adverse impact and moderate adverse effect, which is significant. As a result of the Proposed Development,

this asset will no longer be affected such that the corresponding residual effect would be neutral and not significant.

8.4.26 In the 2013 ES, as amended, no significant effects were reported as a result of permanent impacts on the setting of heritage assets or due to ground settlement resulting from tunnelling. This is expected to remain the case as a result of the Proposed Development.

8.4.27 The 2013 ES, as amended, reported a high permanent adverse impact and permanent negligible adverse effect due to removal of former field boundaries and a former trackway (COL037). This effect is not significant and is expected to remain as a result of the Proposed Development.

8.4.28 The 2013 ES, as amended, reported a permanent medium adverse impact and permanent minor adverse effect due to reduction in field scape associated with the Attleboro Farm and Barns (COL087), a low value asset. This effect is not significant and is expected to remain as a result of the Proposed Development.

Other mitigation and residual effects

8.4.29 No mitigation measures beyond those identified in the 2013 ES, as amended, are required and therefore effects are as described above.

Cumulative effects

8.4.30 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

8.5 Effects arising during operation

Avoidance and mitigation measures

8.5.1 There are no specific measures included as part of the Proposed Development to avoid or reduce impacts to Cultural Heritage.

Assessment of impacts and effects

8.5.2 All permanent construction impacts identified in Section 8.4 of this report would remain throughout operation.

8.5.3 No heritage assets will experience significant effects as a result of permanent changes to their setting arising from operation of the Phase One scheme or the Proposed Development.

Other mitigation and residual effects

8.5.4 No other mitigation measures are required and therefore effects are as described above.

Cumulative effects

8.5.5 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

8.6 Summary

8.6.1 No new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme.

8.6.2 Significant effects reported in the 2013 ES, as amended, will no longer occur in relation to the following heritage assets, as a result of the Proposed Development:

- The site of the former Castle Bromwich airfield and military WWII factories (CBB016);
- Great House of Park Hall (CBB020);
- The extant remains of the walled garden of Park Hall (CBB018);
- The site of a dovecote (CBB014);
- The remains of a bridge (CBB015);
- Outbuildings within Park Hall (CBB022);
- A platform located within Park Hall nature reserve (CBB086);
- Ridge and furrow (CBB087 and CBB094);
- Ditches, leats or former watercourses (CBB010, CBB088, CBB089, CBB090, CBB092, CBB093, CBB095, CBB096 and CBB097);
- A trackway (hollow way) at Park Hall (CBB033);
- Parkhill Wood (CBB023);
- A saw pit within Parkhill Wood (CBB025);
- Park Hall Wood (CBB007 and CBB008);
- Langley Hill Wood (CBB030);
- Former channel to River Tame (CBB081); and
- The site of a prehistoric burnt mound Park Hall (CBB032).

8.6.3 Significant effects reported in the 2013 ES, as amended, will be reduced to minor effects, which are not significant, for the following heritage assets as a result of the construction of a temporary access track as part of the Proposed Development.

- Park Hall Deer Park (CBB012);
- Ridge and furrow (CBB021, CBB029, CBB031, CBB082, CBB083 and CBB084);
- Medieval fields (CBB005);
- Drains, possible water meadows and medieval fields (CBB003 and CBB064); and
- Trackway (CBB091).

8.6.4 Archaeological remains associated with the undated cropmarks of a possible field system south of Water Orton (COL092) and the ridge and furrow earthworks south of Water Orton (COL044) would not be affected by design changes resulting from the Proposed Development such that effects reported in the 2013 ES, as amended, would remain.

8.6.5 In comparison to the Phase One scheme, the Proposed Development would not result in any new or different adverse significant effects.

8.6.6 In the case of cultural heritage, the Proposed Development represents an improvement, compared with the Phase One scheme, in respect of cultural heritage. 26 heritage assets would no longer be affected and would remain undisturbed by the Proposed Development compared to the Phase One scheme. The impacts to a further 11 heritage assets would be reduced with these assets being only partially removed, whereas previously, in the case of the Phase One scheme, they would be fully removed.

9 Ecology and biodiversity

9.1 Introduction

9.1.1 The environmental baseline relevant to the ecology and biodiversity assessment is described below. Any new or different likely significant adverse environmental effects as a result of the Proposed Development are then identified, compared to those reported in the 2013 ES, as amended.

9.2 Scope assumptions and limitations

9.2.1 The assessment scope, key assumptions and limitations for ecology and biodiversity are as 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) of the 2013 ES, as amended.

9.2.2 The impact assessment methodology for the Phase One scheme and Proposed Development follow the standard methodology for ecology as set out by the Institute of Ecology and Environmental Management (IEEM) in their Guidelines for Ecological Impact Assessment (2006)[20] and follows the approach outlined in the SMR and SMR Addendum. These guidelines have been superseded by the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland (2018)[21]. However, the new guidance would not fundamentally affect the approach to the assessment previously undertaken (2013 ES, as amended) and therefore the approach remains valid for the purposes of considering the Proposed Development.

9.2.3 Information relating to the potential impacts of the design changes on ecological receptors, including designated sites, habitats and protected species, has been obtained from the following sources:

- the 2013 ES, as amended; and
- survey data obtained since submission of the Environmental Statement.

9.2.4 A gap analysis of survey data completed in March 2020 found that the majority of ecological survey data within this area is out of date based on the SMR or industry guidance. However, except for Park Hall SINC, which is largely outside the land required for the Proposed Development, habitats are of relatively low ecological value, comprising improved grassland, arable land and species poor

[20] Institute of Ecology and Environmental Management (IEEM), 2006, Guidelines for Ecological Impact Assessment, IEEM
[21] Available at: https://cieem.net/wp-content/uploads/2018/08/ECIA-Guidelines-2018-Terrestrial-Freshwater-Coastal-and-Marine-V1.1Update.pdf

hedgerows. The 2013 ES, as amended reported that these habitats were of local/ parish value or below. Due to the low value of the habitats and the relatively short time that has elapsed since surveys were undertaken, it is considered unlikely that the ecological baseline within this area would have changed considerably and therefore this does not present a significant limitation to the findings of the assessment.

9.2.5 The key design change relevant to the ecology and biodiversity assessment is the extension of Bromford tunnel by over 3km, which passes beneath Park Hall nature reserve and Site of Importance for Nature Conservation (SINC). This avoids the need for the construction of the Water Orton cutting within the SINC, diversion of a National Grid overhead power line, diversion of a fuel pipeline and creation of a large flood storage area within the SINC.

9.3 Environmental Baseline

Existing baseline

9.3.1 The ecological baseline for the assessment takes into account baseline information collected in support of the 2013 ES, as amended (see Volume 2: CFA Report 25, Section 7 and SES1 and AP2 ES Volume 2: CFA Report 25, Section 3.2). Baseline information included field survey data, aerial photography and relevant existing information gathered from national organisations and from regional and local sources. A summary of the baseline information relevant to the assessment is provided below.

Designated sites

9.3.2 No statutory designated sites were reported within the 2013 ES, as amended, as being within 500m of the Phase One scheme. However, Beechcroft Local Nature Reserve (LNR) is a statutory site, which has been designated since submission of the 2013 ES, as amended (refer to section 9.3.4).

9.3.3 The non-statutory designated sites within 500m of land required, as reported in the 2013 ES, as amended (see SES1 and AP2 ES, Volume 2):

- Park Hall SINC (also a nature reserve managed by the Wildlife Trust for Birmingham and the Black Country) is designated for its broadleaved semi-natural woodland (including one area listed on the ancient woodland inventory), scrub, marshy grassland, swamp vegetation and water bodies, as well as the plants, aquatic invertebrates (including four species of County Rare[22] diving beetle), amphibians and birds these habitats support. The SINC

[22] 'County Rare' refers to 'Notable' (Chadd & Extence, 2004) species that are scarce in the West Midlands. Chadd, R. and Extence, C. (2004), The conservation of freshwater macro-invertebrate: a community-based scheme. Aquatic Mar. Freshw. Ecosyst. 14:597-624.

was assessed as being of county/ metropolitan value in the 2013 ES, as amended. The SINC is approximately 44ha and is located partially within land originally required for the Phase One scheme and the Proposed Development.

- Water Orton Sidings SLINC is approximately 1.5ha and is located to the north of the M6 and immediately east of the railway triangle north of Park Hall Nature Reserve, approximately 85m from, and outside land required for the Phase One scheme and the Proposed Development. The SLINC is designated for its calcareous grassland and the diverse assemblage of plants and terrestrial invertebrates that this habitat type supports. The SLINC was assessed as district/ borough value within the 2013 ES, as amended. This SLINC is located outside the land originally required for the construction of the Phase One scheme and the Proposed Development.
- River Tame SLINC is approximately 3.2ha and flows through the area to the east of Birmingham city centre, between the M6 and the Birmingham and Derby line. The SLINC is notified for its watercourse habitats, which are known to support bullhead, birds, bats, otters and other species. The SLINC also contains areas of marshy grassland and swamp; and supports a variety of species including meadow foxtail, cuckoo flower and the County Rare meadow-rue. The SLINC was assessed as being of district/ borough value within the 2013 ES, as amended. Sections of the SLINC are located within the land originally required for the construction of the Phase One scheme, including where it flows through Park Hall SINC, as reported in the 2013 ES, as amended. However, the SLINC is outside land required for the Proposed Development, approximately 390m west.
- Three separate woodland parcels located within Park Hall SINC comprise designated ancient woodland and are of county/ metropolitan value. These are Park Hall (2.96 ha); Parkhill measuring approximately 3.9ha and Langley Woods measuring approximately 2.2ha. These areas of woodland were not designated as ancient woodland at the time that the 2013 ES, as amended, was written, although these areas were reported as ancient within the SES1 and AP 2 following a review of historic data sources. These areas of ancient woodland were partially within land originally required for the Phase One scheme. These areas of ancient woodland are outside land required for the Proposed Development.

9.3.4 Since the submission of the 2013 ES, as amended, the following updates to the baseline should be noted:

- There is one statutory designated site located within 500m of the land required for the construction of the Proposed Development; Beechcroft Local Nature Reserve (LNR), located immediately to the south of the M6 and the A452. The LNR was designated in 2016 and therefore was not included in the impact assessment within the 2013 ES as amended. This site is also

designated as a Local Wildlife Site (LWS). The LNR is approximately 4.4ha and is 114m south of the land originally required for the Phase One scheme and the Proposed Development.

- Castle Bromwich Hall Park LWS is designated due to a diverse range of habitats including neutral grassland, marshy grassland and swamp, as well as woodland, hedgerows, scrub and an avenue of trees. The LWS is approximately 12.5ha and is 350m from land originally required for the Phase One scheme and Proposed Development. The LWS is of district/ borough value. The LWS was not referenced within the 2013 ES, as amended.

Habitats

9.3.5 There are areas of broadleaved semi-natural woodland located within Park Hall SINC, within the land originally required to construct the Phase One scheme. These are reported in the 2013 ES, as amended, as being of good ecological condition and of county/metropolitan value. This habitat is partially within land required for the Proposed Development (although less land is within land required compared with the Phase One scheme).

9.3.6 The River Tame flows through Park Hall SINC. The watercourse is a habitat of principal importance listed in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006). The River Tame is of district/borough value. The watercourse is within land required for the Phase One scheme, but this habitat is outside land required for the Proposed Development.

9.3.7 An area of approximately 3.2ha of marshy grassland occurs on the floodplain of the River Tame within Park Hall SINC. The marshy grassland is a habitat of principal Importance and is of county/metropolitan value. This habitat is within the land required for the Phase One scheme. Land take from this habitat is reduced as a result of the Proposed Development but minimal areas of this habitat are within land required.

9.3.8 A 1.4ha area of swamp and reed bed vegetation occurs within Park Hall SINC, within land originally required for the Phase One scheme. The areas of swamp are habitats of principal importance and are of district/borough value. A minimal area of swamp habitat is within land required for the Proposed Development.

9.3.9 There are 17 ponds located in Park Hall SINC, within the land required for the Phase One scheme. These ponds support typical species diversity and collectively are of county/metropolitan value. Ponds outside of Park Hall SINC (and outside of the land required) are of district/borough value. There are no ponds within land required for the Proposed Development.

9.3.10 As reported in the 2013 ES, as amended, sections of species-poor hedgerow occur within the land originally required for construction of the Phase One scheme and within land required for the Proposed Development, totalling approximately 780m in length. These are not defined as important under the wildlife and landscape criteria specified in the Hedgerows Regulations 1997. These hedgerows are collectively of local/parish value.

9.3.11 Large areas of species-rich and species-poor neutral grassland occur within and around the floodplain of the River Tame at Park Hall SINC. These habitats exist within the land originally required to construct the Phase One scheme. Areas of species-rich grasslands at Park Hall SINC are of county/metropolitan value. Where grassland within the SINC are species-poor grasslands, these habitats are of local/parish value. Minimal areas of this habitat are within land required for the temporary and the permanent works for the Proposed Development.

9.3.12 Dense and/or scattered scrub occurs in the area south of Dunlop Way and west of the A452 Chester Road, within the railway triangle north of Park Hall SINC and within the SINC, some of which are within land originally required to construct the Phase One scheme and Proposed Development, although the areas of scrub are required for the Proposed Development compared with the Phase One scheme Each individual area of scrub is small in extent and is of local/parish value.

9.3.13 Areas of tall ruderal vegetation occur within land required for the Phase One scheme. These are outside land required for the Proposed Development. Collectively they are of local/parish value.

9.3.14 Scattered broadleaved trees occur within Park Hall SINC all of which lie within the land originally required to construct the Phase One scheme but outside land required for the Proposed Development. Whilst they are likely to have colonised naturally, they represent a semi-natural habitat type which is small in extent. They are collectively of local/parish value.

Species

9.3.15 Table 9.3.1 provides a summary of the assemblages of protected/notable species located within the Phase One scheme site. The species assemblages have largely been recorded within Park Hall SINC.

Table 9.3.1 Protected and/or notable species

Species	Assemblage details	Location	Value
Flora			
Dittander	N/A	Park Hall SINC	County/metropolitan value

Species	Assemblage details	Location	Value
Marsh Stitchwort	N/A	Park Hall SINC	District/borough value
River water crowfoot	N/A	Park Hall SINC	District/borough value
Sweet briar	N/A	Park Hall SINC	District/borough value
Fauna			
Aquatic-macro invertebrates	Four species of county rare diving beetle; *Hygrotus nigrolineatus, Hygrotus confluens, Hydroglyphus geminus* and *Ilybius guttiger*. Three other species of diving beetle of notable conservation importance; *Rhantus suturalis, Helochares lividus* and *Ilybius guttiger*.	Park Hall SINC	County/metropolitan value
Terrestrial Invertebrates	A species of crane fly on the GB Red List; Limoniidae *Limnophila pictipennis*. A true fly on the GB Red List; Fanniidae *Piezura graminicola*. A notable nationally scarce true weevil; Curculionoidea *Aulacobaris lepidii*. A notable nationally scarce soldier beetle; Cantharidae *Crudosilis ruficollis*.	Park Hall SINC	County/metropolitan value
Amphibians	A metapopulation of great crested newt (GCN) *Triturus cristatus*.	Park Hall SINC	District/borough value
Amphibians	Metapopulations of common frog *Rana temporaria*, common toad *Bufo bufo* and smooth newt *Lissotriton vulgaris*.	Park Hall SINC	District/borough value
Reptiles	A population of grass snake *Natrix natrix*.	Park Hall SINC	Local/parish value
Reptiles	A population of grass snake *Natrix natrix*.	Railway triangle north of Park Hall SINC	Local/parish value
Fish	Moderate populations of; common gudgeon, minnow, stone loach, three-spined	River Tame SINC	Local/parish value

Species	Assemblage details	Location	Value
	Stickleback and Bullhead.		
Birds	A breeding population of grasshopper warbler *Locustella naevia*.	Park Hall SINC	County/ metropolitan value
Birds	Wintering populations of woodcock *Scolopax* and green sandpiper *Tringa ochropus*.	Park Hall SINC	District/borough value
Birds	Small breeding populations of kingfisher *Alcedo atthis* and garden warbler *Sylvia borin*.	Park Hall SINC	District/borough value
Birds	Breeding populations of song thrush *Turdus philomelos*, mallard *Anas platyrhynchos*, stock dove *Columba oenas*, whitethroat *Sylvia communis*, dunnock *Prunella modularis* and reed bunting *Emberiza schoeniclus*.	Park Hall SINC	Local/parish value
Water voles	A small population.	On River Tame where it passes through Park Hall SINC	County/ metropolitan value
Otters	A small population and an artificial otter holt.	On River Tame where it passes through Park Hall SINC	District/borough value
Badgers	A main badger sett and an outlier sett.	Undisclosed location	Local/parish value
Bats	A population of common pipistrelle *Pipistrellus pipistrellus*.	Park Hall SINC and the River Tame	District/borough value
Bats	Small populations of *Myotis sp*., Noctule *Nyctalus noctula*, Leisler's *Nyctalus leisleri*, brown long-eared bat *Plecotus auritus*, serotine *Eptesicus serotinus*, soprano pipistrelle *Pipistrellus pygmaeus* and *Nyctalus sp*.	Park Hall SINC	Local/parish value

9.3.16 Since the submission of the 2013 ES, as amended, an update to the baseline has been made. Update Surveys carried out in 2020 have recorded a medium population of GCN within scattered ponds. The GCN population is situated

within a predominately agricultural landscape south of Water Orton. This population is assessed as being of district / borough value.

Future environmental baseline

Construction

9.3.17 The 2013 ES, as amended, identified one committed development (CFA25/4) that would affect the character and value of the ecological baseline of the Phase One scheme. This was for the erection of an employment building for B8 (storage and distribution) use, associated access, parking, drainage and landscaping at Prologis, Minworth, Sutton Coldfield would result in the loss of 8.2ha of the railway triangle north of Park Hall SINC, which is partially within land permanently required for the Phase One scheme, whereby a Public Right of Way (PRoW) will be installed. The 2013 ES, as amended, reported that CFA25/4 would have potential to reduce the current ecological value at this location with regard to wintering birds. It is also likely that this development would reduce the value of the swamp habitat in this area from district/ borough importance to local/ parish importance by the date at which construction of the Phase One scheme commences because there would only be a small extent of this habitat of principal importance remaining. CFA25/4 has now been constructed and therefore the swamp habitat in this area is considered to be of local/ parish value.

Operation

9.3.18 There are no known committed developments or changes to management in this area that will affect the operational baseline of the Phase One scheme, as reported in the 2013 ES, as amended. The future baseline for operation therefore remains unchanged.

9.4 Effects arising during construction

Avoidance and mitigation measures

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

Assessment of impacts and effects

Designated Sites

9.4.2 Park Hall SINC is within land required for the Phase One scheme. The 2013 ES, as amended, reported that there would be loss of ancient broadleaved woodland, broadleaved semi-natural woodland, swamp, reed bed as well as neutral, semi-improved and marshy grassland habitats within Park Hall SINC. The Phase One

scheme would result in approximately 34.9ha of habitat (representing 79% of the site) and would have a permanent adverse effect on site integrity that is significant at a county/ metropolitan level.

9.4.3 Parkhall, Parkhill and Langley Woods are areas of designated ancient woodland located within Park Hall SINC. The 2013 ES, as amended, reports there being 5.8ha of broadleaved semi-natural woodland within the SINC, 3ha of which are listed on the Ancient Woodland Inventory. The 2013 ES, as amended, states that there would be permanent loss of 2.7ha of broadleaved semi-natural woodland and 0.7ha of ancient woodland. Approximately 23% of the ancient woodland would be lost and the remaining areas of the broadleaved semi-natural woodland would be affected. Although not all of the woodland would be directly impacted by the works, the fragments that will remain will be isolated and are predicted to decline in value, such that their biodiversity interest would be effectively lost. The Phase One scheme would result in a permanent effect on ancient woodland significant at county/ metropolitan level.

9.4.4 The Proposed Development includes the extension of Bromford tunnel and removal of compounds associated with the Bromford viaduct, reducing the land requirements within Park Hall SINC. On a precautionary basis the Proposed Development will result in 0.11ha permanent loss (broadleaved woodland and dense scrub) and 0.94ha temporary loss (semi-improved grassland; swamp; marshy grassland; dense scrub and broadleaved plantation woodland) of Park Hall SINC (refer to section 9.4.12 for a breakdown of habitat loss within the SINC). No loss or impact to areas of designated ancient woodland will occur as a result of the Proposed Development. In terms of habitat loss, effects arising from the Proposed Development are considerably reduced from that reported in the 2013 ES, as amended.

9.4.5 The habitats within the SINC are partially dependant on groundwater in superficial deposits; however, the proposed tunnelling will not affect groundwater within these deposits and therefore indirect impacts due to groundwater on retained habitats are not anticipated (for further information refer to Section 18 of this report).

9.4.6 Due to temporary habitat loss resulting from installation of the western extent of the access track and the permanent loss of habitats for installation of the eastern extent of the access track, an adverse effect on Park Hall SINC at local/ parish level (not significant) is anticipated during construction of the Proposed Development.

9.4.7 The 2013 ES, as amended, reported that the realignment of the River Tame SLINC where it flows through Park Hall SLINC as a result of the Phase One scheme would result in a significant effect at district/ borough level. As a result

of the Proposed Development the Rive Tame no longer requires realignment, removing the effects on the River Tame SLINC. No indirect effects on the River Tame SLINC are anticipated as a result of groundwater impacts. Instrumentation and monitoring of utilities, to be in place during the construction phase are proposed near, but outside the extent of, the SLINC. Works will be in accordance with the CoCP; with these measures in place, the Proposed Development will have no likely significant effect on the River Tame SLINC.

9.4.8 The 2013 ES, as amended, reported a no impact on Water Orton Sidings SLINC as a result of the Phase One Scheme. The Proposed Development will also have a no likely significant effect on the SLINC as no direct or indirect effects are anticipated due to measures outlined in the CoCP.

9.4.9 The effects of the Phase One Scheme on Beechcroft LNR and LWS were not reported in the 2013 ES, as amended, as the site was only designated in 2016. The Proposed Development will not result in any direct effects as the designated sites are outside land required for the Proposed Development. These designated sites have not been identified as groundwater dependant and no indirect effects are anticipated. The Proposed Development will have no likely significant effect on these designated sites.

9.4.10 The effects of the Phase One scheme on Castle Bromwich Hall Park LWS were not reported in the 2013 ES, as amended. This designated site is outside land required for the Phase One scheme and Proposed Development. As reported in Section 1 of this report, this designated site is likely to be partially dependant on groundwater in the superficial deposits in this area. However, the Bromford tunnel extension would pass below these features within the underlying Mercia Mudstone Group and so the proposed work would not affect groundwater in the superficial deposits. The Proposed Development will have a no likely significant effect on the LWS.

Habitats

9.4.11 As a consequence of the Phase One Scheme, the 2013 ES, as amended, reported the following effects on habitats:

- Loss of approximately 5.8ha of woodland at Langley Woods Ancient Semi-Natural Woodland (ASNW), resulting in a permanent adverse effect on the conservation status of this habitat which will be significant at the county/ metropolitan level.
- Loss of 3.2ha of marshy grassland at Park Hall SINC resulting is a permanent adverse effect on the conservation status of this habitat significant at the county/ metropolitan level.

- Loss of 15.3ha of species-rich neutral grassland and 4.9ha of species-poor neutral grassland resulting in a permanent adverse effect on the conservation status of species-rich grasslands which will be significant at the county/ metropolitan level, and on species-poor grasslands which will be significant at the local/ parish level (not significant).
- Loss of 1.4ha of swamp vegetation at Park Hall SINC resulting in a permanent adverse effect on this habitat which will be significant at the district/ borough level.
- Loss of 17 ponds and approximately 265m of ditch habitat resulting in a permanent adverse effect at county/ metropolitan level.

9.4.12 These habitats are largely outside land required for the Proposed Development and therefore the permanent effects on habitats as described above in paragraph 9.4.11 will be avoided in the most part. However, works have already been undertaken to install the western section of an access track within Park Hall SINC and widen and realign the eastern section, which have resulted in permanent loss of 0.08ha broadleaved plantation woodland 0.03ha dense scrub and temporary loss of the following habitats (refer to sections 9.4.14 – 9.4.18 for further details):

- 0.43ha semi-improved grassland
- 0.1ha swamp
- 0.3ha marshy grassland
- 0.08 ha broadleaved plantation woodland
- 0.03ha of dense scrub

9.4.13 As reported in Section 1, some habitats within the SINC are likely to be partially dependant on groundwater in the superficial deposits in this area. However, the proposed Bromford tunnel extension would pass below these features within the underlying Mercia Mudstone Group and so the proposed work would not affect groundwater in the superficial deposits.

9.4.14 Temporarily, during construction, there will be an adverse effect on semi-improved grassland due to the lack of this habitat type within the local area, outside of Park Hall SINC. The effect would be significant at district/ borough level. Once this habitat has been reinstated there will be no likely significant effect on this habitat.

9.4.15 Loss of small areas of swamp and marshy grassland habitat on a temporary basis (0.1ha and 0.3ha respectively) , to be reinstated post construction, would not result in significant effects on these habitats.

9.4.16 Due to the lack of this habitat type within the surrounding area, permanent loss of broadleaved plantation woodland habitat would result in an effect on this habitat type at local/ parish level, which is not significant.

9.4.17 The permanent loss of a small area of dense scrub (0.03ha) would have no likely significant effect on this habitat type.

9.4.18 Remaining habitats to be affected within the Proposed Development site comprise arable land, poor semi-improved grassland, improved grassland, species-poor hedgerows, scattered trees and scrub. It is considered unlikely that any effects on habitat receptors within the Proposed Development site at more than the local/ parish level will occur, which are not significant.

9.4.19 Overall, the effect on habitats as a result of the Proposed Development is considerably reduced from the Phase One scheme and are not likely to be significant.

Species

9.4.20 The 2013 ES, as amended, reported the following effects on protected and notable species as a result of habitat loss described above in respect of the Phase One scheme:

- Permanent adverse effect on the conservation status of aquatic macro-invertebrate populations at Park Hall SINC significant at county/metropolitan level.
- Permanent adverse effect on the conservation status of water vole populations on the River Tame where it passes through Park Hall SINC significant at county/metropolitan level.
- Temporary adverse impact on otter populations on the River Tame where it passes through Park Hall SINC will be significant at district/ borough level and is anticipated to have duration of between one and three years.
- Permanent adverse effect on the conservation status of common pipistrelles at Park Hall SINC and the River Tame significant at the district/borough level. For all other species of bat recorded during the survey period, habitat loss will result in an adverse effect that is significant at local/ parish level (not significant).
- Decline of great crested newt populations at Park Hall SINC and potential local extinction. This would result in a permanent adverse effect on the conservation status of the local metapopulation that is significant at district/ borough level.
- Loss of habitat for common frog, common toad and smooth newt metapopulations at Park Hall SINC which would lead to population declines and potential local extinctions. This would result in a permanent adverse

effect on the conservation status of these local metapopulations significant at district/ borough level.

- Permanent adverse effect on the conservation status of green sandpiper and woodcock at Park Hall SINC significant at district/ borough level.
- Permanent adverse effect on the conservation status of the grasshopper warbler population at Park Hall SINC significant at county/ metropolitan level.
- Permanent adverse effect on the conservation status of the terrestrial invertebrate assemblage at Park Hall SINC significant at county/ metropolitan level.
- Temporary adverse effect on the conservation status of kingfisher at Park Hall SINC significant at district/ borough level and is anticipated to have a duration of between one and three years.
- Permanent adverse effect on the conservation status of the garden warbler population at Park Hall SINC significant at district/ borough level.
- Permanent adverse effect on the conservation status of the small breeding bird assemblage (excluding kingfisher, garden warbler and grasshopper warbler) at Park Hall SINC, significant at local/ parish level (not significant).
- Permanent adverse effect on the conservation status of the rare and notable plant assemblage within Park Hall SINC that is significant at district/ borough level.

9.4.21 Habitat loss has already occurred within Park Hall SINC as part of the Phase One scheme to accommodate an installation of the western extent of an access track, with the eastern section slightly widened and realigned. However, due to the relatively small scale of habitat loss (see 9.4.12), which will be carried out in accordance with the CoCP, no impacts to species receptors within the SINC are anticipated.

9.4.22 The Proposed Development will adversely affect GCN populations located within predominantly arable land to the south of Water Orton due to a small net loss of terrestrial habitat and reduced connectivity to habitats southward of the breeding ponds. The effect is anticipated at local/ parish level (not significant).

9.4.23 In summary, there are no likely significant effects on species as a result of the Proposed Development.

Cumulative effects

9.4.24 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

9.5 Effects arising during operation

Avoidance and mitigation measures

9.5.1 There are no specific measures required during operation to mitigate adverse effects on ecological receptors as a result of the Proposed Development.

Assessment of impacts and effects

9.5.2 The 2013 ES, as amended, reports that a medium sized population of common pipistrelle within Park Hall SINC is likely to be impacted (as a result through collisions with passing trains or associated turbulence) where it bisects a known bat dispersal corridor. This is likely to represent a permanent adverse effect on the conservation status of the local common pipistrelle population significant at the district/borough level. As the Proposed Development is in tunnel at this location, there will be no effect on bats within the Proposed Development site and therefore the significant effect reported in the 2013 ES, as amended, is removed.

9.5.3 It is not likely that any other effects on species receptors at more than the local/ parish level (not significant) will occur during operation as a result of the Phase One Scheme. Effects at the local/parish level are listed in Volume 5 (Appendix EC-005-004) of the 2013 ES, as amended. This is also true for the Proposed Development.

Other mitigation and residual effects

9.5.4 To mitigate effects on common pipistrelles as a result of the Phase One scheme, additional planting would be provided at specific locations within Park Hall SINC to encourage the dispersal of bats beneath the River Tame viaduct, and hence minimise the risk of potential collision with trains. Once established, this would have reduced the effects on common pipistrelle bats to local/parish level, which is not significant.

9.5.5 The planting described above to mitigate effects on common pipistrelles is not required for the Proposed Development as adverse effects to local bat populations will not occur. There are no specific measures required during operation to mitigate effects of the Proposed Development.

Cumulative effects

9.5.6 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from.

9.6 Summary

9.6.1 There will be no new or different significant adverse effects as a result of the Proposed Development.

9.6.2 The Proposed Development would avoid significant adverse effects in respect of habitats within and surrounding Park Hall Site of Importance for Nature Conservation (SINC), largely negating the significant effects which arose from habitat loss in this area as a result of the Phase One scheme.

9.6.3 The works would, however, have an adverse effect on the Park Hall SINC, and habitats supported by the SINC, at a local/ parish level, during construction. By following the CoCP, there would be no significant effect on protected and notable species supported by the SINC. 0.7 ha of designated ancient woodland located within the SINC would be removed as a result of the Phase One Scheme and the remaining 2.3ha would be fragmented and are predicted to decline in value, such that their biodiversity interest would be effectively lost. These effects would be avoided as a result of the Proposed Development, with no direct or indirect effects on ancient woodland anticipated.

9.6.4 Ecological receptors to be affected within the Proposed Development site outside Park Hall SINC are of limited value to ecology, with the exception of a medium population of great crested newts that would be affected to the south of Water Orton (identified since the 2013 ES, as amended). The Proposed Development would result in an impact on this population at local/ parish level, and not considered significant.

9.6.5 The 2013 ES, as amended, reported operational effects on populations of common pipistrelle bat, to be mitigated through additional woodland planting. No significant effects on ecological receptors, including common pipistrelle, would occur as a result of the Proposed Development during operation.

9.6.6 The ecological effects of the Proposed Development, as described above, are of a much-reduced scale compared to those of the Phase One scheme. Once proposed habitat reinstatement has been undertaken there would be a few remaining ecological effects, resulting from the Proposed Development, all of which would be non-significant.

10 Health

10.1 Introduction

10.1.1 This section identifies the communities within the study area that will be subject to impacts associated with the Proposed Development and describes how the changes may affect the health and wellbeing of people within these communities, where these effects are considered to be consequential.

10.2 Scope assumptions and limitations

10.2.1 This section deals specifically with impacts at a local level within the study area. Health effects assessed across the Phase One scheme as a whole were assessed in the route-wide health assessment contained in HS2 Phase One Health Impact Assessment (Phase One HIA)[23].

10.2.2 The health effects of the Phase One scheme were reported in a route-wide HIA as there was no requirement for health impacts to be included within the 2013 ES, as amended, at the time. Since then, the Town and Country Planning (Environmental Impact Assessment) Regulations 2017 set out a requirement for consideration of health impacts within EIA as a specific topic chapter.

10.2.3 In the absence of a specific EIA SMR on health accompanying the 2013 ES, as amended, the scope, assumptions and limitations for this health assessment were drawn from the Scope and Methodology Report for HS2 Phase 2b[24]("the Phase 2b SMR").

10.2.4 As set out in the Phase 2b SMR, the health assessment is based on a broad understanding of health, consistent with the World Health Organization (WHO) definition of health as 'a state of complete physical, mental and social well-being and not merely an absence of disease or infirmity'. An individual's health is mostly determined by genetics and lifestyle factors, but for a large enough population many other factors, or 'health determinants', are known to be important, and these factors may be affected by the Proposed Development.

10.2.5 The assessment considered the impacts of the Proposed Development on a range of environmental and socio-economic 'health determinants', which could

[23] HS2 Phase One Health Impact Assessment, November 2013. An addendum to the Phase One HIA was produced in September 2015 to accompany Supplementary Environmental Statement 2 (SES 2) and Additional Provisions 3 (AP3). The document presented an assessment of the revised scheme for Euston stations and the surrounding area only. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/378711/Health_impact_assessment.pdf

[24] HS2 Phase 2b Scope and Methodology Report, October 2018. Available at: https://www.gov.uk/government/publications/hs2-phase-2b-environmental-impact-assessment-scope-and-methodology-report

result in adverse or beneficial effects on health and wellbeing. Based on this a professional judgement was made to identify those effects on population health and wellbeing that were sufficiently important to report within the health assessment sections found in this report.

10.2.6 The health determinants of relevance within the study area were:

- for impacts during construction (temporary and permanent): neighbourhood quality; access to services, health and social care; access to green space, recreation and physical activity and social capital. No effects on the health determinant relating to education were anticipated.
- no impacts during operation were anticipated.

10.2.7 The geographic extent of the health assessment covers those areas where impacts on health determinants were predicted to occur. The study area was 1km from the route of the HS2 railway.

10.2.8 The health assessment was based on a review of evidence linking changes in health determinants to potential health outcomes[25]. The strength of evidence varied; for example, the evidence linking physical activity to health outcomes was strong, whereas the evidence linking social capital with health outcomes was moderate. The strength of evidence did not necessarily determine the importance of a health effect but was an indication of the level of certainty in the assessment. Additionally, there was greater certainty in the prediction of an impact on a health determinant than the consequent effect on health.

10.2.9 There is no established or widely accepted framework for assessing the significant health effects of a development proposal. The Phase 2b SMR sets out a methodology for describing the impacts on health determinants in terms of the magnitude and duration of the change and the extent of the population exposed to this change. It also draws attention to the strength of evidence that links a change in health determinant with health effects. This framework permitted the assessment to describe the impacts on determinants in a largely qualitative manner, with some structure to the relative scale of these impacts to give a sense of the importance of the potential health effects. This does not, however, provide a clear basis for drawing conclusions as to whether a health effect was likely to be 'significant'.

[25] HS2 Phase 2a environmental statement technical appendices: Route-wide commentary on health evidence base, Available at:
https://www.gov.uk/government/publications/hs2-phase-2a-environmental-statement-volume-5-health

10.2.10 The key design change relevant to the health assessment was the extension of Bromford tunnel by over 3km, and the resultant changes in temporary and permanent requirement for land and change in construction compounds.

10.3 Environmental Baseline

Existing baseline

Description of communities

10.3.1 The route of the Proposed Development through the area would be principally in tunnel and therefore above ground infrastructure would be restricted to the location of a vent shaft and two tunnel portals. The area is predominantly urban, comprising a road transport corridor, commercial development and some residential communities in Water Orton, Castle Vale and Bromford.

10.3.2 The description of communities has been summarised from the baseline information provided in the 2013 ES Community assessment, as amended, relating to the Proposed Development.

10.3.3 Water Orton is located to the north and west of the Proposed Development, bounded to the south by the M6 and the east by the M42 and M6 Toll. The village has a good range of community facilities, open spaces and recreational facilities. Pursuant to the Phase One scheme, Water Orton Primary School has been relocated Vicarage Lane to a site off Plank Lane, Water Orton. There is also a day nursery that operates from next to the where the school used to be located at Vicarage Lane which is called The Tree House of Water Orton.

10.3.4 Castle Vale is a residential community located approximately six miles north east of Birmingham city centre. Within the residential area of Castle Vale, the Berwood Court Care Home is within the study area and would be within close proximity to works associated with the Proposed Development.

10.3.5 There is a gypsy and traveller site within the study area, located to the south of the Castle Vale estate, within the Castle Bromwich Business Park on Tameside Drive. Castle Vale provides a wide range of facilities to serve the local neighbourhood, and a number of facilities to the south of the estate will be in close proximity to the Proposed Development. A number of open spaces and recreational facilities are within land required by the Phase One scheme; these are Park Hall nature reserve (to the south of the Castle Vale estate and north of the M6), Blenheim Way public open space (to the east of Castle Vale estate) and Farnborough Road Park (also located to the east of Castle Vale estate).

10.3.6 Bromford provides a range of local facilities that serve the Firs and Bromford residential area. The only community facility within the study area is the

Bromford Bridge North East public open space, which would be be partially within an area of land required by the Proposed Development.

Demographic and health profile

10.3.7 A review of publicly available health and demographic information has been undertaken to inform the health assessment. The information gathered describes the populations that could be affected by the Proposed Development in terms of their key characteristics such as size, distribution, age structure, socio-economic status and health. It enabled consideration of the nature of the populations affected and their sensitivity to potential health effects, as well as indicated the prevalence of specific vulnerable groups.

10.3.8 The communities that would be affected by the Proposed Development have a relatively high population density commensurate with the urban nature of the area.

10.3.9 Data from local authority health profiles[26] show that this population has a worse health status compared with the national (England) averages.

10.3.10 The English Indices of Deprivation[27] rank neighbourhoods from most to least deprived, according to a range of criteria and an overall (combined) ranking. The neighbourhoods in the area are generally more deprived than the national average.

10.3.11 This area as a whole is considered to be less resilient than the national average, with regard to changes in the relevant health determinants, and with some vulnerabilities in terms of the health status of the population.

10.3.12 The available data provide detail down to local authority and ward level and enable a profile to be made of the population within the area. The description of the whole population, and the populations within wards, does not preclude the possibility that there will be individuals or groups of people who do not conform to the overall profile.

[26] Public health indicators have been benchmarked to show how a local authority compares to England for each specific indicator. The benchmark is presented on a three-point scale: worse than, similar to and better than (the English average). These benchmarks have been used in the community profile. Details and an example profile can be found at: https://fingertips.phe.org.uk/profile/health-profiles/data#page/1/gid/1938132701/pat/6/par/E12000005/ati/102/are/E08000025/iid/90366/age/1/sex/1/cid/4

[27] Ministry of Housing, Communities and Local Government (formerly Department for Communities and Local Government) (2019), English Indices of Deprivation 2019. Available at: https://www.gov.uk/government/statistics/english-indices-of-deprivation-2019

Future environmental baseline

Construction

10.3.13 No committed developments have been identified in this study area that would materially affect the future baseline conditions during construction, for health.

Operation

10.3.14 No committed developments have been identified in this study area that would materially affect the future baseline conditions during operation, for health.

10.4 Effects arising during construction

Avoidance and mitigation measures

10.4.1 The EMRs for the HS2 Phase One scheme include a commitment to produce and implement a community engagement framework and provide appropriately experienced community relations personnel. HS2 Ltd will engage with local authorities and community representatives to identify measures aimed at fostering and maintaining good relationships between the workforce and local communities.

Assessment of impacts and effects

Neighbourhood quality

10.4.2 The term 'neighbourhood quality' was used in this assessment to describe the combination of environmental factors that influence people's experience of, and feelings about, their local environment. When these factors are altered people's levels of satisfaction with their living environment may change. In turn, this could affect mental wellbeing or behaviours such as the use of outside space.

10.4.3 The construction of the Proposed Development would affect neighbourhood quality through impacts such as noise, air emissions, visual impacts and additional traffic, including heavy goods vehicles (HGV). The Community section provides a combined assessment and identifies locations that are subject to significant environmental effects on two or more topics (e.g. noise and visual).

10.4.4 The assessment looked at changes in character, tranquillity and amenity across the neighbourhood as a whole, including streets and other public and private outdoor areas. This was judged on a case-by-case basis, taking into account the characteristics of each neighbourhood. The assessment was informed by the findings from other assessments, but did not rely on the same significance thresholds, as it did not focus on individual receptors. The assessment of health and wellbeing effects considered issues such as people's feelings of attachment

to, and pride in, their neighbourhood and enjoyment of outside space, and how these may change.

10.4.5 The Phase One scheme's HIA considered health impacts associated with changes to the local environment, including visual effects and changes to local character, noise and air quality. This was considered at a route-wide level and therefore no specific locations were identified in CFA 19 and CFA25.

10.4.6 Construction works to the south of Water Orton, including construction of the Attleboro flyover, the Attleboro Lane realignment and overbridge, Water Orton cutting and Attleboro Farm embankment and associated earthworks and retaining structures, would involve the demolition of properties on Attleboro Lane. Construction noise would be noticeable in outdoor areas for approximately three years. People in this community would be likely to experience these features of the Proposed Development as changing the quality of their neighbourhood and to regard that change as adverse.

Access to services, health and social care

10.4.7 There is strong evidence linking access to health and social care services with mental and physical health outcomes, both directly, through access to treatment and care, or access to fresh food retailers, and indirectly through issues such as access to social networks. There is also weak to moderate evidence to suggest that transport problems are a key barrier to people's ability to access these services. There is moderate evidence to suggest that access to shops and other local facilities can affect health. This is based on a range of factors affecting quality of life and includes mental health issues such as reducing feelings of isolation and enabling participation in society, and physical health issues such as food shopping and other basic needs.

10.4.8 Berwood Court care home is located on Berwood Park to the south of the Castle Vale community. The home accommodates approximately 70 residents, including elderly and dementia patients. It provides elderly care services, including rehabilitation care, and respite care. The 2013 ES, as amended, identified a significant effect on the amenity of the residents of the care home for approximately seven months.

10.4.9 The Proposed Development would be expected to result in significant noise effects on Berwood Care Home, consistent with effects of the Phase One scheme, reported in the 2013 ES, as amended, but not significant visual effects on Berwood Court care home. Therefore, the assessment of noise effects reports the likely effects on Berwood Court care home and no additional health effects have been predicted.

Access to green space, recreation and physical activity

10.4.10 There is moderate evidence to show that access to green space contributes to good mental health. There is also moderate evidence that environmental factors such as access to high quality green space, safety and local amenity, can influence participation in physical activity. Physical activity is strongly linked to health outcomes.

10.4.11 The Phase One scheme's HIA reported health impacts on Park Hall nature reserve. The nature reserve comprises approximately 36ha of grassland, wetlands and ancient woodlands, and is an important resource for local people and visitors. The Phase One scheme's HIA reported that during construction, the nature reserve will be closed to visitors for approximately five years, plus a further year for reinstatement. The result of closure of the site would reduce access to green space, which is associated with a range of health benefits. For the Proposed Development the reduction in access would remain the same.

10.4.12 Farnborough Road Park provides large areas of parkland in the south-eastern extent of Castle Vale, providing 5.2ha of public open space including a local equipped area for play (LEAP), outdoor gym, skate park, four adult football pitches, two junior football pitches, four mini football pitches, one floodlit court (currently disused) five picnic areas, seating areas, litterbins and car parking. The space is very well used, with particularly high usage of the play area during the summer. The Phase One HIA identified Farnborough Road Park as an area for formal and informal exercise. The Phase One scheme resulted in a minor temporary requirement for land (16%), minor permanent requirement for land (11%) and some minor land requirements and temporary changes to amenity for users (for three years).

10.4.13 For the Proposed Development, the temporary and permanent requirements for land would be much less and there is not expected to be any significant visual effects, and therefore users are not expected to experience deterioration in amenity. Therefore, the Proposed Development would be expected to reduce health effects on Farnborough Road Park.

10.4.14 As a result of the Proposed Development, construction traffic, including HGVs, would be present on local roads. Given the location of construction traffic routes and the number of HGV movements, it was considered that any reduction in physical activity will be small and would not lead to adverse health effects on the population.

Social capital

10.4.15 The connections between individuals within communities, and the increased likelihood that arises through these networks for individuals to feel valued, to feel a sense of belonging, to have companionship and to support each other, is important for health and wellbeing. A measure of the effectiveness of these connections within communities is termed 'social capital' and is a recognised determinant of health. The Office for National Statistics defines social capital as follows:

"In general terms, social capital represents social connections and all the benefits they generate. Social capital is also associated with civic participation, civic-minded attitudes and values which are important for people to cooperate, such as tolerance or trust."[28]

10.4.16 There is moderate evidence for a link between social capital and health and wellbeing outcomes. A change in social capital has the potential to influence health effects that are gained through social contact and support, social participation, reciprocity and trust. Adverse effects on health from changes in social capital could be experienced as a reduction in wellbeing or as physiological effects on the body's hormonal and immune systems, with increased susceptibility to mental and physical illness.

10.4.17 The introduction of a temporary construction workforce into established communities has the potential to negatively alter people's perceptions of, and interactions with, their communities, modifying behaviour and the value they place on social capital.

10.4.18 During the day, the workforce would be present on construction sites and compounds throughout the area, including main compounds and satellite compounds in the vicinity of Water Orton, Castle Vale and Bromford. The Proposed Development would require fewer construction compounds than the Phase One scheme. The following Phase One compounds would no longer be required: River Tame viaduct satellite compound, Plants Brook underbridge satellite compound, Dunlop carrier channel culvert satellite compound and Bromford tunnel east portal (east) main compound. As the Bromford tunnel would be extended and there would be a requirement for a vent shaft, the original Bromford tunnel east portal (west) satellite compound would now become the Bromford intermediate shaft satellite compound. The duration of the works at the Bromford intermediate shaft satellite compound would be the same as the duration of works of the Phase One scheme compound at this location, approximately five years and three months. The total number of

[28] Office for National Statistics (2014), Measuring social capital. Available at: https://webarchive.nationalarchives.gov.uk/20160107115718/http://www.ons.gov.uk/ons/dcp171766_371693.pdf

construction workers in the study area would not be expected to change. The presence of construction workers would likely be noticeable however the size of the temporary construction workforce are unlikely to be substantial relative to the size of these communities and therefore no health effects are expected.

Other mitigation and residual effects

10.4.19 No other mitigation measures were required and therefore effects are as described above.

Cumulative effects

10.4.20 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

10.5 Effects arising during operation

Avoidance and mitigation measures

10.5.1 No avoidance or mitigation measures, additional to those reported in the Phase One HIA and CoCP, have been identified.

Assessment of impacts and effects

10.5.2 No operational health effects were predicted to occur at the community level.

Other mitigation and residual effects

10.5.3 No other mitigation measures were proposed.

Cumulative effects

10.5.4 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

10.6 Summary

10.6.1 The 2013 ES, as amended, did not include an assessment of the Phase One scheme on human health; the assessment was contained within a separate HIA report.

10.6.2 The health effects of the Proposed Development are, in most cases, similar to the effects reported for the Phase One scheme for the health determinants of access to green space, access to services, health and social care, recreation and

physical activity and social capital. This screening assessment was more specific in its reporting on the neighbourhood quality health determinant; it identified people in several communities would likely experience features of the Proposed Development as changing the quality of their neighbourhood and to regard that change as adverse. The assessment of the Proposed Development was more specific than the Phase One HIA report in identifying the locations of communities predicted to experience these effects, together with the nature, magnitude and sensitivity of the effects. However, the Proposed Development is not expected to result in any new or different adverse health effects, as compared with those reported in the Phase One HIA report.

11 Land Quality

11.1 Introduction

11.1.1 This section of the report presents the baseline conditions that exist along the Proposed Development in relation to land quality. Any new or different likely significant adverse environmental effects as a result of the Proposed Development are then identified, compared to those reported in the 2013 ES, as amended.

11.2 Scope assumptions and limitations

11.2.1 The assessment scope, key assumptions and limitations for land quality assessment are as 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) of the 2013 ES, as amended. This land quality screening assessment has applied the same assessment approach. With respect to assessment conclusions, major and moderate effect significance categories are considered to comprise significant effects for the purposes of the EIA Regulations.

11.2.2 Consideration has been 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. These include geological sites of special scientific interest (SSSI), local geological sites (LGS), areas of current underground or opencast mining and areas of designated mineral resources. A review of potential mitigation measures to control or reduce land quality impacts is also included. The framework for the review of potential land contamination impacts is a source-pathway-receptor model which describes the potential contaminant exposure linkages between soil, water and gas contaminants and human, property and environmental receptors. The assessment of the effect of contamination is undertaken by comparing potential contaminated land sites, and the risks that they pose to receptors, at baseline against construction and post-construction stages.

11.2.3 The change to the scheme that influences the assessment relates to the Castle Bromwich Business Park which contains a range of historical and currently contaminative activities. In the Phase One scheme the Castle Bromwich retained cut was located through this area. The Proposed Development eliminates this retained cut and replaces it with a deep tunnel and an intermediate vent shaft resulting in considerably less disturbance to potentially contaminated soil.

11.3 Environmental Baseline

Existing baseline

11.3.1 The 2013 ES, as amended, identified a series of Land Quality Sites that had the potential to impact identified receptors as a result of the proposed works. Those relevant to the Phase One scheme and Proposed Development are set out in Table 11.4.1, in relation to which no updates are considered necessary. Potentially contaminated sites have been grouped, and assessed together, where appropriate. Further details on the basis for the conceptual site model (CSM) groups is presented in Volume 5: Appendix LQ-001-025 of the 2013 ES, as amended. This screening assessment considers the land quality effects within 250m of the Proposed Development and within 1000m for the assessment of groundwater. The groups are defined as follows:

- CSM Group A: Sites within the land required to construct the Proposed Development, potentially containing soil/groundwater contamination and ground gas;
- CSM Group B: Sites within the land required to construct the Proposed Development, potentially containing soil/groundwater contamination only;
- CSM Group C: Sites that fall outside of the land required to construct the Proposed Development, potentially containing soil/groundwater contamination and ground gas; and
- CSM Group D: Sites that fall outside of the land required to construct the Proposed Development, potentially containing soil/groundwater contamination only.

11.3.2 Table 11.4.1 present a list of Land Quality Sites and receptors identified in relation to the Phase One scheme, set out within the 2013 ES, as amended, which are also relevant to the Proposed Development. Additional Land Quality sites have not been identified since the 2013 ES, as amended.

Table 11.4.1 Relevant Land Quality Sites and Receptors

CSM Group	Environmental Statement (2013 ES, as amended) Land Quality Ref	Environmental Statement (2013 ES, as amended) Land Quality Description	Receptors
CSM Group A Sites[2]	25-134 & 25-135	Worked / Infilled land, Class 2 Historical Land Use.	**Sensitive Land Use:** None **Aquifer:** Superficial Secondary A Aquifer (Alluvium, River Terrace Deposits) Bedrock Secondary B Aquifer (Mercia Mudstone) **Surface Watercourse:** River Tame Ponds in Park Hall Site of Importance for Nature Conservation (SINC) and nature reserve **Geological or Ecological Designations:** Park Hall SINC and nature reserve **Property:** No significant mineral resources. Commercial buildings and infrastructure present throughout. Buildings and structures (potentially affected by ground gas)
	25-92	Infilled Land, Class 3 Historical Land Use.	
	25-130	Infilled Pond, Class 2 Historical Land Use.	
	25-6	Castle Bromwich Waste Treatment Site former landfill, currently Tameside Drive Civic Amenity Site and Castle Bromwich Incinerator Bottom Ash Processing Facility, Class 3 Historical Land Use.	
	25-14	British Car Auctions / Former Tameside Drive - Langley Drive Landfill Site, Class 3 current and historical land use.	
	25-16	Former Tameside Drive - Langley Drive Landfill Site, Class 3 historical land use.	
CSM Group B Sites[2]	25-8	Hayward Industrial Estate/Castle Bromwich Business Park, Class 2 Current and Historical Land Use	**Sensitive Land Use:** Housing in Castle Vale and Ward End, Playing field, play area, public open space Park Hall SINC and nature reserve
	25-17	Former Abattoir, Class 3 Historical Land Use	

CSM Group	Environmental Statement (2013 ES, as amended) Land Quality Ref	Environmental Statement (2013 ES, as amended) Land Quality Description	Receptors
	25-18		**Aquifer:** Superficial Secondary A Aquifer (Alluvium, River Terrace Deposits) Bedrock Secondary B Aquifer (Mercia Mudstone) **Surface Watercourse:** River Tame Overflow Channel Ponds **Geological or Ecological Designations:** Park Hall SINC and nature reserve **Property:** No significant mineral resources. Residential and Commercial buildings and infrastructure present throughout.
	25-80	Former Sewage Works, Class 2 Historical Land Use	
	25-82	Former Fertiliser Works, Class 3 Historical Land Use	
	25-88	Esso Pipeline, Class 2 Current Land Use	
	25-113	Railway Land Within CFA25, Class 2 Current and Historical Land Use	
CSM Group C Sites[(2)]	25-89	Worked / Infilled Land, Class 3 Historical Land Use	**Sensitive Land Use:** Housing in Ward End Schools (Park Hall Academy and Chivenor Primary) Public Open Space, playing field and allotment gardens **Aquifer:** Superficial Secondary A Aquifer (Alluvium, River Terrace Deposits)
	25-11	Former Tameside Drive - Langley Drive Landfill Site, Class 3 historical land use.	
	25-12		
	25-13		
	25-15		

CSM Group	Environmental Statement (2013 ES, as amended) Land Quality Ref	Environmental Statement (2013 ES, as amended) Land Quality Description	Receptors
	25-86	Former Castle Vale Tip / Former Sewage Works, Class 3 Historical Land Use	Bedrock Secondary B Aquifer (Mercia Mudstone) **Surface Watercourse:** River Tame Drain **Geological or Ecological Designations:** Park Hall SINC and nature reserve **Property:** No significant mineral resources. Commercial buildings and infrastructure present throughout. Buildings and Structures (potentially affected by gas)
	25-136	Worked / Infilled Land, Class 2 Historical Land Use	
CSM Group D Sites[(2)]	25-4	Former Aerodrome, Class 3 Historical Land Use	**Sensitive Land Use:** Housing within Castle Vale and Ward End, Schools (Castle Vale, Pegasus Primary, Chivenor Primary and Park Hall), Play Areas, Playing Fields, Stadium, Park Hall SINC and nature reserve, Public Open Space. **Aquifer:** Superficial Secondary A Aquifer (Alluvium, River Terrace Deposits) Bedrock Secondary B Aquifer (Mercia Mudstone) **Surface Water Courses:**
	25-5		
	25-84		
	25-87		
	25-10	Dura Automotive Body and Glass Systems Ltd, Class 2 Current Land Use	
	25-23	Fort Industrial Park, Class 2 Current and Historical Land Use	

CSM Group	Environmental Statement (2013 ES, as amended) Land Quality Ref	Environmental Statement (2013 ES, as amended) Land Quality Description	Receptors
			River Tame, Plants Brook, Drain/Overflow Channel **Geological or Ecological Designations:** Park Hall SINC and nature reserve **Property:** No significant mineral resources. Residential and Commercial buildings and infrastructure present throughout.
River Tame realignment and replacement floodplain storage area in Park Hall SINC	25-88 (within construction boundary)	Former Castle Vale Tip / Former Sewage Works, Class 3 Historical Land Use	**Sensitive Land Use:** Housing in Castle Vale, Schools (Park Hall Academy) Play Areas, Playing Fields, Stadium, Park Hall SINC and nature reserve, Allotment gardens **Aquifer:** Superficial Secondary A Aquifer (Alluvium, River Terrace Deposits) Bedrock Secondary B Aquifer (Mercia Mudstone) **Surface Water Courses:** River Tame, Plants Brook, Drain/Overflow Channel, Ponds
	25-92 (within construction boundary)	Infilled Land, Class 3 Historical Land Use.	
	25-134 & 25-135 (within construction boundary)	Worked / Infilled land, Class 2 Historical Land Use.	
	25-4 (outside construction boundary)	Former Aerodrome, Class 3 Historical Land Use	

CSM Group	Environmental Statement (2013 ES, as amended) Land Quality Ref	Environmental Statement (2013 ES, as amended) Land Quality Description	Receptors
	25-6 (outside construction boundary)	Castle Bromwich Waste Treatment Site former landfill, currently Tameside Drive Civic Amenity Site and Castle Bromwich Incinerator Bottom Ash Processing Facility, Class 3 Historical Land Use.	**Geological or Ecological Designations:** Park Hall SINC and nature reserve **Property:** No significant mineral resources. Residential and Commercial buildings and infrastructure present throughout. Buildings and structures (potentially affected by gas)
	25-80 & 25-82 (outside construction boundary)	Former Sewage Works, Class 2 Historical Land Use	
	25-86 (outside construction boundary)	Former Castle Vale Tip / Former Sewage Works, Class 3 Historical Land Use	
	25-130 (outside construction boundary)	Infilled Pond, Class 2 Historical Land Use.	
	25-136 (outside construction boundary)	Worked / Infilled Land, Class 2 Historical Land Use	
Bromford tunnel east portal and Approach in Castle Bromwich retained cut	25-6 (within construction boundary)	Castle Bromwich Waste Treatment Site former landfill, currently Tameside Drive Civic Amenity Site and Castle Bromwich Incinerator Bottom Ash Processing Facility, Class 3 Historical Land Use.	**Sensitive Land Use:** Housing in Castle Vale and Ward End Schools (Chivenor Primary School) Play Areas, Playing Fields, Park Hall SINC and nature reserve **Aquifer:** Superficial Secondary A Aquifer (Alluvium, River Terrace Deposits)
	25-8 (within construction boundary)	Hayward Industrial Estate/Castle Bromwich Business Park, Class 2 Current and Historical Land Use	

CSM Group	Environmental Statement (2013 ES, as amended) Land Quality Ref	Environmental Statement (2013 ES, as amended) Land Quality Description	Receptors
	25-14 (within construction boundary)	British Car Auctions / Former Tameside Drive - Langley Drive Landfill Site, Class 3 current and historical land use.	Bedrock Secondary B Aquifer (Mercia Mudstone) **Surface Water Courses:** River Tame, Plants Brook, Overflow Channel **Geological or Ecological Designations:** Park Hall SINC and nature reserve **Property:** No significant mineral resources. Residential and Commercial buildings and infrastructure present throughout. Buildings and structures (potentially affected by gas)
	25-16 (within construction boundary)	Former Tameside Drive - Langley Drive Landfill Site, Class 3 historical land use.	
	25-82 (within construction boundary)	Former Fertiliser Works, Class 3 Historical Land Use	
	25-88 (within construction boundary)	Former Castle Vale Tip / Former Sewage Works, Class 3 Historical Land Use	
	25-113 (within construction boundary)	Railway Land Within CFA25, Class 2 Current and Historical Land Use	
	25-11, 25-12 & 25-15 (outside construction boundary)	Former Tameside Drive - Langley Drive Landfill Site, Class 3 historical land use.	
	25-17 & 25-18 (outside construction boundary)	Former Abattoir, Class 3 Historical Land Use	

CSM Group	Environmental Statement (2013 ES, as amended) Land Quality Ref	Environmental Statement (2013 ES, as amended) Land Quality Description	Receptors
	25-84 (outside construction boundary)	Former Aerodrome, Class 3 Historical Land Use	

11.3.3 A number of land-uses that are considered to have the potential to represent specific contamination sources for the Proposed Development, include the former Castle Bromwich Waste Treatment Site landfill and Tameside Drive-Langley Drive landfill (2013 ES, as amended, Volume 5: Map LQ-01-067 as sites 25-6, D6, and 25-11 to 25-16, C7), where the construction of the proposed intermediate shaft will be required. An electricitical substation will also be constructed in the vicinity of the proposed Bromford tunnel east portal. Risks from this are low and there are no Land Quality sites identified by the 2013 ES, as amended, in the immediate proximity of the structure.

11.3.4 The main environmental receptors of this area relevant to the Proposed Development include the following:

- The River Tame, Plants Brook and linking surface drainage and overflow channels and large areas of superficial sand and gravel deposits which constitute a Secondary A aquifer.
- Human receptors occupy densely populated residential areas and their associated community facilities, and adjacent commercial facilities.
- Park Hall SINC and nature reserve is an area of potential ecological sensitivity. An access track traverses the nature reserve allowing for the installation of monitoring instrumentation for the purpose of assessing ground movement. The nature reserve will be returned to its original condition upon completion of the monitoring works.

11.3.5 Principal contaminant exposure pathways are considered to be located at the Bromford tunnel east portal and the intermediate ventilation shaft noted above. Whilst tunnelling will generate significant quantities of excavated materials, this will predominantly comprise of natural Mercia Mudstone.

11.3.6 Since the 2017 Act, additional receptors have been identified and are presented Table 11.4.2. In addition, as set out in Section 2 of this report, planning permission has been granted for new residential properties along Birmingham Road, Water Orton. Further to the 2017 Act, Water Orton Primary School has been relocated from a site off Vicarage Lane to a site off Plank Lane, Water Orton. The additional receptors presented in Table 11.4.2 are included in the subsequent CSM tables for the Proposed Development.

Table 11.4.2 Additional receptors relevant to the Proposed Development

Receptor	Main Potential Impact
Recently constructed Water Orton Primary School	Potential impact on human health adjacent to site (long term)
	Potential Impact on Property Receptors (buildings, foundations and services)

Receptor	Main Potential Impact
Residential receptor (Temporary accommodation (static caravan) located at Twisted Oak Stables)	Potential impact on human health adjacent to site (long term)
	Potential Impact on Property Receptors (buildings, foundations and services)
Structures previously proposed to be demolished in the Castle Bromwich Industrial Estate, which are now to be retained (including demolished structures that will be rebuilt post-construction).	Potential impact on human health adjacent to site (long term)
	Potential Impact on Property Receptors (buildings, foundations and services)

11.3.7 The baseline risk identified in the 2013 ES, as amended, is provided in Table 11.4.3. 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. Details of the identified risk sites are presented in the Volume 5: Appendix LQ-001-025, 2013 ES, as amended.

11.3.8 A Mineral Safeguarding Area (MSA) for sand and gravel is identified within the Proposed Development north of the Bromford tunnel east portal. Ground investigation undertaken since the 2013 ES, as amended, included boreholes within the MSA in the proximity of the Proposed Development, which indicated the absence of sands and gravels. In the absence of sand and gravel deposits within this area, mining and mineral sites are not considered to be a relevant receptor for the Proposed Development or the Phase One scheme and are not considered further.

11.3.9 No geo-conservation areas such as SSSI or LGS are present in the study area and such sites are therefore not considered further.

Table 11.4.3 Summary of Baseline Risk identified in the 2013 ES, as amended

Area Ref	Area Name	Main Potential Impacts	Main Baseline Risk
CSM Group A Sites: 25-06, 25-14, 25-16, 25-92, 25-130, 25-134 and 25-135 (shown on Volume 5: Map LQ-01-067	Key Sites include: Former landfill sites (Castle Bromwich Waste Treatment Site, Tameside Drive-Langley Drive Site) Current industrial Units (British Car Auctions, Civic Amenity Site and Castle Bromwich Incinerator Bottom Ash Processing Facility)	Potential impact on human health on site (long term)	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low
		Potential impact on groundwater quality	Moderate / Low
		Potential impact on surface water quality	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low
CSM Group B Sites: 25-08, 25-17, 25-18, 25-64, 25-78, 25-80, 25-82, 25-88 and 25-113 (shown on Volume 5: Maps LQ-01-066b to LQ-01-068a)	Key sites include: Former aerodrome, abattoir, railway station, sewage works, fertiliser works, engineering works, infilled land and railway land Current Castle Bromwich Business Park, Esso pipeline, railway land, and various small industrial/commercial units	Potential impact on human health on site (long term)	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low
		Potential impact on groundwater quality	Moderate / Low
		Potential impact on surface water quality	Moderate / Low

Area Ref	Area Name	Main Potential Impacts	Main Baseline Risk
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low
CSM Group C Sites: 25-89, 25-11, 25-12, 25-13, 25-15, 25-86 and 25-136 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Key sites include: Former landfill sites	Potential impact on human health on site (long term)	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low
		Potential Impact on Groundwater Quality	Moderate / Low
		Potential impact on surface water quality	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low
CSM Group D Sites: 25-4, 25-5, 25-84, 25-87, 25-10 and 25-23 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Key sites include: Former aerodrome, former tanks, tube works, infilled land and railway land Current Dura Automotive Body and Glass Systems, railway land, Fort Industrial Park, National Grid storage yard and various small commercial/industrial units	Potential impact on human health on site (long term)	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low
		Potential impact on groundwater quality	Moderate / Low
		Potential impact on surface water quality	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low

Area Ref	Area Name	Main Potential Impacts	Main Baseline Risk
Site Specific CSM: River Tame Realignment through Park Hall SINC and Flood Compensation 25-04, 25-06, 25-80, 25-82, 25-86, 25-88, 25-92, 25-130, 25-134, 25-135, and 25-136 shown on Volume 5: Map LQ-01-067	Within land required to construct the Proposed Development: Current Esso pipeline outside of land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site, Castle Vale Tip), sewage works, fertiliser works, aerodrome Current civic amenity site, Castle Bromwich incinerator bottom ash processing facility	Potential impact on human health on site (long term)	Low to Very Low
		Potential impact on human health adjacent to site (long term)	Very Low
		Potential impact on groundwater quality	Moderate / Low
		Potential impact on surface water quality	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low
Site Specific CSM: Eastern Tunnel Portal and Approach 25-06, 25-08, 25-11, 25-12, 25-14, 25-15, 25-16, 25-17, 25-18, 25-82, 25-84, 25-88, 25-113 shown on Volume 5: Map LQ-01-067	Within land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site landfill, Tameside Drive-Langley Drive – landfill), fertiliser works. Current Castle Bromwich incinerator bottom ash processing facility, civic amenity site, Castle Bromwich Business Park Outside of the land required to construct the Proposed Development: Tameside Drive-Langley Drive landfill site), aerodrome, sewage works and abattoir.	Potential impact on human health on site (long term)	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low
		Potential impact on groundwater quality	Moderate / Low
		Potential impact on surface water quality	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low

Future environmental baseline

Construction

11.3.10 Committed developments identified in the future baseline for construction reported in the 2013 ES, as amended, are not located within the proximity of the Proposed Development. None of the committed developments identified will affect the baseline. The future baseline for construction remains unchanged from that reported in the 2013 ES, as amended.

Operation

11.3.11 The future baseline for operation remains unchanged from that reported in the 2013 ES, as amended. None of the committed developments identified will affect the baseline.

11.4 Effects arising during construction

Avoidance and mitigation measures

11.4.1 The construction assessment takes into account the mitigation measures contained within the CoCP. The CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Development. The CoCP requires that prior to and during construction a programme of further investigations 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 Development to be constructed safely and to prevent harmful future migration of contaminants.

11.4.2 There are no specific mitigation or avoidance measures included in the design that are relevant to land quality, over and above those contained within the CoCP.

Assessment of impacts and effects

Construction effects

11.4.3 The construction CSM was compared to the baseline CSM presented in Table 11.4.1 to determine the change in level of risk at receptors during the construction stage, and thus to define the level of effect at the construction stage. 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 moderate. This will be the case where construction does not alter the risks from existing potentially contaminated sites.

11.4.4 The 2013 ES, as amended, identified that the Phase One scheme would result in either no change or a slight increase in the level of risk already existing at each site for both on-site and off-site receptors. However, these effects are assessed as not significant and adoption of remediation measures in accordance with the CoCP makes it unlikely that there will be adverse consequences. However, it is considered that there may still be temporary minor adverse effects during the construction period from ground disturbance in these areas. The 2013 ES, as amended, did not report any likely significant temporary cumulative effects. Table 11.5.1 presents a summary of the temporary (construction) impacts and risks of the Phase One scheme, identified in the 2013 ES, as amended. Residual effects are reported in Table 11.5.1.

11.4.5 Table 11.5.1 presents a summary of temporary (construction) effects resulting from the Proposed Development. Residual effects are reported in Table 11.5.1. The baseline and construction CSM relevant to the proposed development have been compared to determine the change in level of risk at receptors during the construction stage, and thus to define the level of effect at the construction stage.

Table 11.5.1 Summary of Temporary (Construction) Effects and Risks of the Phase One scheme, identified in 2013 ES, as amended, and of the Proposed Development

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
Phase One scheme				
CSM Group A Sites: 25-06, 25-14, 25-16, 25-92, 25-130, 25-134 and 25-135 (shown on Volume 5: Map LQ-01-067	Key Sites include: Former landfill sites (Castle Bromwich Waste Treatment Site, Tameside Drive-Langley Drive Site) Current industrial Units (British Car Auctions, Civic Amenity Site and Castle Bromwich Incinerator Bottom Ash Processing Facility)	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development
		Potential impact on human health adjacent to site (long term)	Low	Low to Moderate / Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low to Moderate
		Potential impact on surface water quality	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate	Moderate / Low to Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Moderate / Low to Moderate
Proposed Development				
CSM Group A Sites[(2)]: 25-06, 25-14, 25-16, 25-92, 25-130, 25-134 and 25-135	Key Sites include: Former landfill sites (Castle Bromwich Waste Treatment Site, Tameside Drive-Langley Drive Site)	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
(shown on Volume 5: Map LQ-01-067	Current industrial Units (British Car Auctions, Civic Amenity Site and Castle Bromwich Incinerator Bottom Ash Processing Facility)	Potential impact on human health adjacent to site (long term)	Low	Low to Moderate / Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low to Moderate
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate	Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Moderate / Low to Moderate
Phase One scheme				
CSM Group B Sites: 25-08, 25-17, 25-18, 25-64, 25-78, 25-80, 25-82, 25-88 and 25-113 (shown on Volume 5: Maps LQ-01-066b to LQ-01-068a)	Key sites include: Former aerodrome, abattoir, railway station, sewage works, fertiliser works, engineering works, infilled land and railway land Current Castle Bromwich Business Park, Esso pipeline, railway land, and various small industrial/commercial units	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development
		Potential impact on human health adjacent to site (long term)	Low	Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low to Moderate

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
		Potential impact on surface water quality	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low to Moderate / Low
Proposed Development				
CSM Group B Sites: 25-08, 25-17, 25-18, 25-64, 25-78, 25-80, 25-82, 25-88 and 25-113 (shown on Volume 5: Maps LQ-01-066b to LQ-01-068a)	Key sites include: Former aerodrome, abattoir, railway station, sewage works, fertiliser works, engineering works, infilled land and railway land Current Castle Bromwich Business Park, Esso pipeline, railway land, and various small industrial/commercial units	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development
		Potential impact on human health adjacent to site (long term)	Low	Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low to Moderate / Low
Phase One scheme				

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
CSM Group C Sites: 25-89, 25-11, 25-12, 25-13, 25-15, 25-86 and 25-136 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Key sites include: Former landfill sites	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low	Low to Moderate / Low
		Potential Impact on Groundwater Quality	Moderate / Low	Moderate / Low to Moderate
		Potential impact on surface water quality	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low to Moderate / Low
Proposed Development				
CSM Group C Sites: 25-89, 25-11, 25-12, 25-13, 25-15, 25-86 and 25-136 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Key sites include: Former landfill sites	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low	Low / Low to Moderate
		Potential Impact on Groundwater Quality	Moderate / Low	Moderate / Low to Moderate

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
		Potential impact on surface water quality	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low to Moderate / Low
Phase One scheme				
CSM Group D Sites: 25-4, 25-5, 25-84, 25-87, 25-10 and 25-23 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Key sites include: Former aerodrome, former tanks, tube works, infilled land and railway land Current Dura Automotive Body and Glass Systems, railway land, Fort Industrial Park, National Grid storage yard and various small commercial/industrial units	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low	Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low to Moderate
		Potential impact on surface water quality	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low to Moderate / Low
Proposed Development				
CSM Group D Sites:	Key sites include:	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
25-4, 25-5, 25-84, 25-87, 25-10 and 25-23 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Former aerodrome, former tanks, tube works, infilled land and railway land Current Dura Automotive Body and Glass Systems, railway land, Fort Industrial Park, National Grid storage yard and various small commercial/industrial units	Potential impact on human health adjacent to site (long term)	Low	Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low to Moderate
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low to Moderate / Low
Phase One scheme				
Site Specific CSM: River Tame Realignment through Park Hall SINC and Flood Compensation 25-04, 25-06, 25-80, 25-82, 25-86, 25-88, 25-92, 25-130, 25-134, 25-135, and 25-136 shown on Volume 5: Map LQ-01-067	Within land required to construct the Proposed Development: Current Esso pipeline Outside of land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site, Castle Vale Tip), sewage works, fertiliser works, aerodrome Current civic amenity site, Castle Bromwich incinerator bottom ash processing facility	Potential impact on human health on site (long term)	Low to Very Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development
		Potential impact on human health adjacent to site (long term)	Very Low	Very Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low to Moderate
		Potential impact on surface water quality	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on Property Receptors (buildings, foundations and services)	Low	Low

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low to Moderate / Low
Proposed Development				
Site Specific CSM: River Tame Realignment through Park Hall SINC and Flood Compensation 25-04, 25-06, 25-80, 25-82, 25-86, 25-88, 25-92, 25-130, 25-134, 25-135, and 25-136 shown on Volume 5: Map LQ-01-067 *The River Tame Realignment is no longer required in Sub-Lot 1.*	Within land required to construct the Proposed Development: Current Esso pipeline Outside of land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site, Castle Vale Tip), sewage works, fertiliser works, aerodrome Current civic amenity site, Castle Bromwich incinerator bottom ash processing facility	Potential impact on human health on site (long term)	Low to Very Low	N/A – Very Low
		Potential impact on human health adjacent to site (long term)	Very Low	N/A – Very Low
		Potential impact on groundwater quality	Moderate / Low	N/A – Moderate / Low
		Potential impact on surface water quality	Moderate / Low	N/A – Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Low	N/A – Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	N/A – Low
Phase One scheme				
Site Specific CSM: Eastern Tunnel Portal and Approach	Within land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site landfill, Tameside	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
25-06, 25-08, 25-11, 25-12, 25-14, 25-15, 25-16, 25-17, 25-18, 25-82, 25-84, 25-88, 25-113 shown on Volume 5: Map LQ-01-067	Drive-Langley Drive – landfill), fertiliser works. Current Castle Bromwich incinerator bottom ash processing facility, civic amenity site, Castle Bromwich Business Park Outside of the land required to construct the Proposed Development: Tameside Drive-Langley Drive landfill site), aerodrome, sewage works and abattoir.	Potential impact on human health adjacent to site (long term)	Low	Low to Moderate / Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low to Moderate
		Potential impact on surface water quality	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Moderate / Low to Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Moderate / Low to Moderate
Proposed Development				
Site Specific CSM: Eastern Tunnel Portal and Approach 25-06, 25-08, 25-11, 25-12, 25-14, 25-15, 25-16, 25-17, 25-18, 25-82, 25-84, 25-88, 25-113 shown on Volume 5: Map LQ-01-067 *Design has changed from a tunnel portal and cutting to*	Within land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site landfill, Tameside Drive-Langley Drive – landfill), fertiliser works. Current Castle Bromwich incinerator bottom ash processing facility, civic amenity site, Castle Bromwich Business Park	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development
		Potential impact on human health adjacent to site (long term)	Low	Low to Moderate / Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low to Moderate
		Potential impact on surface water quality	Moderate / Low	Moderate / Low to Moderate

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Construction Risk
a ventilation shaft and tunnel	Outside of the land required to construct the Proposed Development: Tameside Drive-Langley Drive landfill site), aerodrome, sewage works and abattoir.	Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Moderate
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Moderate / Low

11.4.6 The construction assessments above take into account the mitigation measures as presented in the 2013 ES, as amended, and the CoCP which include the following:

- Techniques such as stabilisation methods, soil washing and bio-remediation to remove oil contaminants may be used. Contaminated soil disposed off-site will be taken to a soil treatment facility, another construction site (for treatment, as necessary, and reused) or to an appropriately permitted landfill site;
- During construction of the Bromford tunnel dewatering may be required which has the potential to mobilise off-site sources of contamination; and
- Realignment of the Esso fuel pipeline to a single crossing will also be required.

Permanent Effects

11.4.7 The magnitude of the permanent effects and their significance has been determined by calculating the change in risk between the main baseline risk (present risk under current conditions) 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. This will be the case where construction does not alter the risks from an existing potentially contaminated site that is outside of the site. Table 11.5.2 presents a summary of the permanent (post-construction) impacts and risks of the Phase One scheme identified in the 2013 ES, as amended. Residual effects are reported in Table 11.8.1.

11.4.8 Table 11.5.2 presents a summary of permanent (post-construction) impacts and risks resulting from the Proposed Development. Residual effects are reported in Table 11.8.1.

Table 11.5.2 Summary of Permanent (Post Construction) Effects and Risks of the Phase One scheme, identified in 2013 ES, as amended, and of the Proposed Development

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Post Construction Risk
Phase One scheme				
CSM Group A Sites: 25-06, 25-14, 25-16, 25-92, 25-130, 25-134 and 25-135 (shown on Volume 5: Map LQ-01-067	Key Sites include: Former landfill sites (Castle Bromwich Waste Treatment Site, Tameside Drive-Langley Drive Site) Current industrial Units (British Car Auctions, Civic Amenity Site and Castle Bromwich Incinerator Bottom Ash Processing Facility)	Potential impact on human health on site (long term)	Moderate / Low	Very Low to Low
		Potential impact on human health adjacent to site (long term)	Low	Very Low to Low
		Potential impact on groundwater quality	Moderate / Low	Very Low to Low
		Potential impact on surface water quality	Moderate / Low	Very Low to Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate	Very Low to Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Very Low to Low
Proposed Development				
CSM Group A Sites: 25-06, 25-14, 25-16, 25-92, 25-130, 25-134 and 25-135 (shown on Volume 5: Map LQ-01-067	Key Sites include: Former landfill sites (Castle Bromwich Waste Treatment Site, Tameside Drive-Langley Drive Site)	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low to Low
		Potential impact on human health adjacent to site (long term)	Low	Low

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Post Construction Risk
	Current industrial Units (British Car Auctions, Civic Amenity Site and Castle Bromwich Incinerator Bottom Ash Processing Facility)	Potential impact on groundwater quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Moderate / Low
Phase One scheme				
CSM Group B Sites: 25-08, 25-17, 25-18, 25-64, 25-78, 25-80, 25-82, 25-88 and 25-113 (shown on Volume 5: Maps LQ-01-066b to LQ-01-068a)	Key sites include: Former aerodrome, abattoir, railway station, sewage works, fertiliser works, engineering works, infilled land and railway land Current Castle Bromwich Business Park, Esso pipeline, railway land, and various small industrial/commercial units	Potential impact on human health on site (long term)	Moderate / Low	Very Low to Low
		Potential impact on human health adjacent to site (long term)	Low	Very Low to Low
		Potential impact on groundwater quality	Moderate / Low	Very Low to Low
		Potential impact on surface water quality	Moderate / Low	Very Low to Low
		Potential Impact on ecological receptors (Park	Low	Very Low

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Post Construction Risk
		Hall SINC and nature reserve)		
Proposed Development				
CSM Group B Sites: 25-08, 25-17, 25-18, 25-64, 25-78, 25-80, 25-82, 25-88 and 25-113 (shown on Volume 5: Maps LQ-01-066b to LQ-01-068a)	Key sites include: Former aerodrome, abattoir, railway station, sewage works, fertiliser works, engineering works, infilled land and railway land Current Castle Bromwich Business Park, Esso pipeline, railway land, and various small industrial/commercial units	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low	Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low
Phase One scheme				
CSM Group C Sites: 25-89, 25-11, 25-12, 25-13, 25-15, 25-86 and 25-136	Key sites include: Former landfill sites	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Post Construction Risk
shown on Volume 5: Maps LQ-01-067 and LQ-01-068a		Potential impact on human health adjacent to site (long term)	Low	Low
		Potential Impact on Groundwater Quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low
Proposed Development				
CSM Group C Sites: 25-89, 25-11, 25-12, 25-13, 25-15, 25-86 and 25-136 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Key sites include: Former landfill sites	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low
		Potential impact on surface waters adjacent to site (long term)	Low	Low
		Potential Impact on Groundwater Quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Post Construction Risk
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low
Phase One scheme				
CSM Group D Sites: 25-4, 25-5, 25-84, 25-87, 25-10 and 25-23 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Key sites include: Former aerodrome, former tanks, tube works, infilled land and railway land Current Dura Automotive Body and Glass Systems, railway land, Fort Industrial Park, National Grid storage yard and various small commercial/industrial units	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low	Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low
Proposed Development				
CSM Group D Sites: 25-4, 25-5, 25-84, 25-87, 25-10 and 25-23 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Key sites include: Former aerodrome, former tanks, tube works, infilled land and railway land	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low	Low

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Post Construction Risk
	Current Dura Automotive Body and Glass Systems, railway land, Fort Industrial Park, National Grid storage yard and various small commercial/industrial units	Potential impact on groundwater quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low
Phase One scheme				
Site Specific CSM: River Tame Realignment through Park Hall SINC and Flood Compensation 25-04, 25-06, 25-80, 25-82, 25-86, 25-88, 25-92, 25-130, 25-134, 25-135, and 25-136 shown on Volume 5: Map LQ-01-067	Within land required to construct the Proposed Development: Current Esso pipeline outside of land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site, Castle Vale Tip), sewage works, fertiliser works, aerodrome Current civic amenity site, Castle Bromwich incinerator bottom ash processing facility	Potential impact on human health on site (long term)	Low	Low
		Potential impact on human health adjacent to site (long term)	Very Low	Very Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Low	Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low
Proposed Development				

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Post Construction Risk
Site Specific CSM: River Tame Realignment through Park Hall SINC and Flood Compensation 25-04, 25-06, 25-80, 25-82, 25-86, 25-88, 25-92, 25-130, 25-134, 25-135, and 25-136 shown on Volume 5: Map LQ-01-067 *The River Tame Realignment is no longer required in Sub-Lot 1.*	Within land required to construct the Proposed Development: Current Esso pipeline otside of land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site, Castle Vale Tip), sewage works, fertiliser works, aerodrome Current civic amenity site, Castle Bromwich incinerator bottom ash processing facility	Potential impact on human health on site (long term)	Low	Low
		Potential impact on human health adjacent to site (long term)	Very Low	Very Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Low	Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Low
Phase One scheme				
Site Specific CSM: Eastern Tunnel Portal and Approach 25-06, 25-08, 25-11, 25-12, 25-14, 25-15, 25-16, 25-17, 25-18, 25-82, 25-84, 25-88, 25-113 shown on Volume 5: Map LQ-01-067	Within land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site landfill, Tameside Drive-Langley Drive – landfill), fertiliser works. Current Castle Bromwich incinerator bottom ash processing facility, civic	Potential impact on human health on site (long term)	Moderate / Low	Very Low to Low
		Potential impact on human health adjacent to site (long term)	Low	Very Low to Low
		Potential impact on groundwater quality	Moderate / Low	Very Low to Low
		Potential impact on surface water quality	Moderate / Low	Very Low to Low

Area Ref	Area Name	Main Potential Impacts	2013 ES, as amended Baseline Risk	Post Construction Risk
	amenity site, Castle Bromwich Business Park Outside of the land required to construct the Proposed Development: Tameside Drive-Langley Drive landfill site), aerodrome, sewage works and abattoir.	Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Very Low to Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Very Low to Low
Proposed Development				
Site Specific CSM: Eastern Tunnel Portal and Approach 25-06, 25-08, 25-11, 25-12, 25-14, 25-15, 25-16, 25-17, 25-18, 25-82, 25-84, 25-88, 25-113 shown on Volume 5: Map LQ-01-067 *Design has changed from a tunnel portal and cutting to a ventilation shaft and tunnel*	Within land required to construct the Proposed Development: Former landfill sites (Castle Bromwich Waste Treatment Site landfill, Tameside Drive-Langley Drive – landfill), fertiliser works. Current Castle Bromwich incinerator bottom ash processing facility, civic amenity site, Castle Bromwich Business Park Outside of the land required to construct the Proposed Development: Tameside Drive-Langley Drive landfill site), aerodrome, sewage works and abattoir.	Potential impact on human health on site (long term)	Moderate / Low	Moderate / Low
		Potential impact on human health adjacent to site (long term)	Low	Low
		Potential impact on groundwater quality	Moderate / Low	Moderate / Low
		Potential impact on surface water quality	Moderate / Low	Moderate / Low
		Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Moderate / Low
		Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Moderate / Low

11.4.9 The Proposed Development will avoid a number of potentially contaminated sites in Castle Bromwich Industrial Estate and Park Hall SINC and nature reserve. These sites will not benefit from remediation provided by the scheme and impacts relative to baseline are therefore likely to be negligible. Mitigation and remediation measures for CSM Group A and B sites within the land required for construction of the intermediate shaft will be necessary. Retention of many of the structures in the vicinity of the ventilation shaft means that these will be receptors in respect of the Proposed Scheme. Disturbance of the historical landfill site underlying the Castle Bromwich Industrial Estate may result in the temporary generation and migration of ground gases towards these receptors. As a result of the Proposed Development, the construction effect regarding land quality is negative and mitigation measures will be required to reduce the construction and post-construction effects from ground gases within the historical landfill. The footprint of the intermediate shaft is not sufficient to require significant remediation of the historical landfill, therefore the beneficial effects of source removal will only be minor and not significant for the adjacent properties.

11.4.10 Where remediation is carried out on sites identified within the land required for construction of the Proposed Development (CSM Groups A and B, and the location of the original Bromford tunnel east portal (now intermediate shaft), in most instances there will be overall negligible to minor beneficial impacts. Where potentially contaminated sites have been identified outside of the land required for the Proposed Development (CSM Groups C and D) these will not be targeted specifically for remediation. Therefore, the residual post-construction effect on these sites is expected to be similar to that defined for the baseline.

Other mitigation and residual effects

11.4.11 Other mitigation measures for contamination sources beyond the site including; risks from off-site ground gas sources to on-site HS2 infrastructure, which will be managed through design, and off-site groundwater sources to on-site and off-site controlled waters receptors which cannot be practicably controlled. As other mitigation measures are not considered practicable, the likely residual significant effects remain as reported in Table 11.4.2.

Cumulative effects

11.4.12 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different significant adverse cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

11.5 Effects arising during operation

Avoidance and mitigation measures

11.5.1 Maintenance and operation of the railway will be in accordance with relevant environmental legislation and good practice such that there are not expected to be corresponding significant effects arising and these matters are not considered further.

Assessment of impacts and effects

11.5.2 The operation of the trains may give rise to minor contamination through leakage of hydraulic or lubricating oils. However, any such leakage or spillage is expected to be very small and unlikely to result in significant contamination.

Other mitigation and residual effects

11.5.3 As no other mitigation measures are considered practicable, the likely residual significant effects remain as reported in Table 11.5.2

Cumulative effects

11.5.4 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

11.6 Summary

11.6.1 With regards to land quality no new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme. The number of contaminated sites in Castle Bromwich Industrial Estate and Park Hall SINC affected by the Proposed Development would be reduced compared with the Phase One scheme. These sites would not benefit from remediation provided by the Phase One scheme and considering that remediation would not be required impacts relative to baseline are therefore likely to be negligible, and therefore not significant. Paragraph 1.2.6 details the test to determine whether an Environmental Statement is required. The fact that Phase One would have improved the baseline, and the Proposed Development does not to such an extent, is not relevant to the screening test. The footprint of the intermediate shaft is not sufficient to require significant remediation of the full extent of the historical landfill; therefore, the beneficial effects of this remediation would only be minor and not significant for the adjacent properties. Disturbance of the historical landfill site underlying Castle Bromwich Industrial Estate would occur as a result of the Proposed Development, which would also be the case in respect of the Phase One scheme; this may result in the temporary generation and migration of ground gases. However, mitigation

measures would be put in place to ensure there are no significant effects. Where remediation is carried out on contaminated sites within the land required for construction of the Proposed Development, there would be residual land quality benefits associated with this remediation, as would be the case in respect of the Phase One scheme.

11.6.2 A summary of the land quality effects resulting from incorporation of the Proposed Development, as compared with those resulting from the Phase One scheme, are set out in Table 11.8.1.

Table 11.8.1 Land Quality effects resulting from incorporation of the Proposed Development, compared with those arising from the Phase One scheme

Area Ref	Main Potential Impacts	Main Baseline Risk	Construction Risk		Post Construction Risk	
			2013 ES	Proposed Development	2013 ES	Proposed Development
CSM Group A Sites: 25-06, 25-14, 25-16, 25-92, 25-130, 25-134 and 25-135 (shown on Volume 5: Map LQ-01-067	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development	Not applicable as receptor no longer present due to land required to construct the Proposed Development	Risk: Very Low to Low Significance: **Negligible to moderate beneficial**	Risk: Moderate / Low to Low Significance: **Negligible to Minor Beneficial**
	Potential impact on human health adjacent to site (long term)	Low	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Very Low to Low Significance: **Negligible to Minor Beneficial**	Risk: Low Significance: **Negligible**
	Potential impact on groundwater quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Very Low to Low Significance: **Minor to moderate Beneficial**	Risk: Moderate / Low Significance: **Negligible**
	Potential impact on surface water quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low Significance: **Negligible**	Risk: Very Low to Low Significance: **Minor to moderate Beneficial**	Risk: Moderate / Low Significance: **Negligible**

Area Ref	Main Potential Impacts	Main Baseline Risk	Construction Risk		Post Construction Risk	
			2013 ES	Proposed Development	2013 ES	Proposed Development
	Potential Impact on Property Receptors (buildings, foundations and services)	Moderate	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate Significance: **Negligible**	Risk: Very Low to Low Significance: **Minor to moderate Beneficial**	Risk: Moderate / Low Significance: **Minor Beneficial**
	Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Very Low to Low Significance: **Minor to moderate Beneficial**	Risk: Moderate / Low Significance: **Negligible**
CSM Group B Sites: 25-08, 25-17, 25-18, 25-64, 25-78, 25-80, 25-82, 25-88 and 25-113 (shown on Volume 5: Maps LQ-01-066b to LQ-01-068a)	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development	Not applicable as receptor no longer present due to land required to construct the Proposed Development	Risk: Very Low to Low Significance: **Negligible to moderate beneficial**	Risk: Moderate / Low Significance: **Negligible**
	Potential impact on human health adjacent to site (long term)	Low	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**	Risk: Very Low to Low Significance: **Negligible to minor beneficial**	Risk: Low Significance: **Negligible**
	Potential impact on groundwater quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low Significance: **Negligible**	Risk: Very Low to Low Significance: **Minor to moderate beneficial**	Risk: Moderate / Low Significance: **Negligible**

Area Ref	Main Potential Impacts	Main Baseline Risk	Construction Risk		Post Construction Risk	
			2013 ES	Proposed Development	2013 ES	Proposed Development
	Potential impact on surface water quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low Significance: **Negligible**	Risk: Very Low to Low Significance: **Minor to moderate beneficial**	Risk: Moderate / Low Significance: **Negligible**
	Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Very Low Significance: **Minor Beneficial**	Risk: Low Significance: **Negligible**
CSM Group C Sites: 25-89, 25-11, 25-12, 25-13, 25-15, 25-86 and 25-136 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Potential impact on human health on site (long term)	Moderate / Low	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**
	Potential impact on human health adjacent to site (long term)	Low	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**
	Potential Impact on Groundwater Quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**
	Potential impact on surface water quality	Moderate / Low	Risk: Moderate / Low to Moderate	Risk: Moderate / Low to Moderate	Risk: Moderate / Low	Risk: Moderate / Low

Area Ref	Main Potential Impacts	Main Baseline Risk	Construction Risk		Post Construction Risk	
			2013 ES	Proposed Development	2013 ES	Proposed Development
			Significance: **Negligible to Minor Adverse**	Significance: **Negligible to Minor Adverse**	Significance: **Negligible**	Significance: **Negligible**
	Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Risks: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**
	Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**
CSM Group D Sites: 25-4, 25-5, 25-84, 25-87, 25-10 and 25-23 shown on Volume 5: Maps LQ-01-067 and LQ-01-068a	Potential impact on human health on site (long term)	Moderate / Low	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**
	Potential impact on human health adjacent to site (long term)	Low	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**
	Potential impact on groundwater quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**

Area Ref	Main Potential Impacts	Main Baseline Risk	Construction Risk		Post Construction Risk	
			2013 ES	Proposed Development	2013 ES	Proposed Development
	Potential impact on surface water quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**
	Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**
Site Specific CSM: River Tame Realignment through Park Hall SINC and Flood Compensation	Potential impact on human health on site (long term)	Low to Very Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development	Risk: N/A – Very Low Significance: **Negligible**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**
	Potential impact on human health adjacent to site (long term)	Very Low	Risk: Very Low Significance: **Negligible**	Risk: N/A Very Low Significance: **Negligible**	Risk: Very Low Significance: **Negligible**	Risk: Very Low Significance: **Negligible**
	Potential impact on groundwater quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: N/A – Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**

Area Ref	Main Potential Impacts	Main Baseline Risk	Construction Risk		Post Construction Risk	
			2013 ES	Proposed Development	2013 ES	Proposed Development
25-04, 25-06, 25-80, 25-82, 25-86, 25-88, 25-92, 25-130, 25-134, 25-135, and 25-136 shown on Volume 5: Map LQ-01-067 *The River Tame Realignment is no longer required in Sub-Lot 1.*	Potential impact on surface water quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: N/A – Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**	Risk: Moderate / Low Significance: **Negligible**
	Potential Impact on Property Receptors (buildings, foundations and services)	Low	Risk: Low Significance: **Negligible**	Risk: N/A – Low Significance: **Negligible**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**
	Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Low	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: N/A – Low Significance: **Negligible**	Risk: Low Significance: **Negligible**	Risk: Low Significance: **Negligible**
Site Specific CSM: Eastern Tunnel Portal and Approach	Potential impact on human health on site (long term)	Moderate / Low	Not applicable as receptor no longer present due to land required to construct the Proposed Development	Not applicable as receptor no longer present due to land required to construct the Proposed Development	Risk: Very Low to Low Significance: **Negligible to moderate beneficial**	Risk: Moderate / Low Significance: **Negligible**
	Potential impact on human health adjacent to site (long term)	Low	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Low to Moderate / Low Significance: **Negligible to Minor Adverse**	Risk: Very Low to Low Significance: **Negligible to minor beneficial**	Risk: Low Significance: **Negligible**

Area Ref	Main Potential Impacts	Main Baseline Risk	Construction Risk		Post Construction Risk	
			2013 ES	Proposed Development	2013 ES	Proposed Development
25-06, 25-08, 25-11, 25-12, 25-14, 25-15, 25-16, 25-17, 25-18, 25-82, 25-84, 25-88, 25-113 shown on Volume 5: Map LQ-01-067 *Design has changed from a tunnel portal and cutting to a ventilation shaft and tunnel*	Potential impact on groundwater quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Very Low to Low Significance: **Minor to moderate beneficial**	Risk: Moderate / Low Significance: **Negligible**
	Potential impact on surface water quality	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Very Low to Low Significance: **Minor to moderate beneficial**	Risk: Moderate / Low Significance: **Negligible**
	Potential Impact on Property Receptors (buildings, foundations and services)	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Very Low to Low Significance: **Minor to moderate beneficial**	Risk: Moderate / Low Significance: **Negligible**
	Potential Impact on ecological receptors (Park Hall SINC and nature reserve)	Moderate / Low	Risk: Moderate / Low to Moderate Significance: **Negligible to Minor Adverse**	Risk: Moderate / Low Significance: **Negligible**	Risk: Very Low to Low Significance: **Minor to moderate beneficial**	Risk: Moderate / Low Significance: **Negligible**

12 Landscape and visual

12.1 Introduction

12.1.1 This section of the report describes the environmental baseline in relation to landscape and visual amenity that is relevant to the assessment. It then identifies any new or different likely significant adverse environmental effects as a result of the Proposed Development, as compared with the Phase One scheme.

12.2 Scope assumptions and limitations

12.2.1 The assessment scope, key assumptions and limitations for landscape and visual assessment are as 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) of the 2013 ES, as amended. This landscape and visual screening assessment has applied the same assessment approach. With respect to assessment conclusions, major and moderate effect significance categories are considered to comprise significant effects for the purposes of the EIA Regulations. Consistent with the 2013 ES, as amended, night-time visual amenity is considered (in respect of baseline and impact assessment) only for residential, hotel and healthcare receptors with a view of proposed continuous lighting during either construction or operation.

12.2.2 Section 2 of this report provides a description of the Proposed Development. Key changes from the Phase One scheme that are relevant to landscape and visual amenity, are as follows:

- extension of Bromford tunnel from Castle Bromwich Business Park to the Water Orton area, replacing above ground railway infrastructure proposals in this area, with Bromford tunnel east portal and associated infrastructure located south west of Water Orton;
- replacement of Bromford tunnel east portal and other ancillary infrastructure with Bromford tunnel intermediate shaft at Castle Bromwich Business Park;
- inclusion of an electrical substation adjacent to Water Orton cutting and Attleboro Lane overbridge;
- relocation of a balancing pond and associated access track near Water Orton;
- Removal of overhead power line works between Water Orton and Castle Bromwich Business Park; and
- altered landscape proposals, particularly those integral to the Proposed Development at Bromford tunnel east portal and the electrical substation.

12.2.3 The Bromford tunnel west portal does not form part of the Proposed Development as operational design changes are not proposed in respect of the west portal, however there would be a reduction in construction activity at this location as a result of the Proposed Development, as set out in Section 2. As the Bromford tunnel west portal does not form part of the Proposed Development and reduced construction activity at this location would not result in new or different significant adverse landscape and visual effects, this aspect is not considered further within this section of the report.

12.3 Environmental Baseline

Existing baseline

12.3.1 Relevant baseline information provided within the 2013 ES, as amended, is provided below, together with subsequent updates. Corresponding plans, illustrations, photographs and other supporting material are found within Volume 2 (Community Forum Area reports CFA19 Coleshill Junction and CFA25 Castle Bromwich and Bromford) and Volume 5 (Appendix: LV-001-019 and Appendix: LV-001-025) of the 2013 ES, as amended (SES1 and AP2; SES3 and AP4). Since the 2017 Act, a residential property (static caravan) has been identified at the Twisted Oak Stables, Birmingham Road, Water Orton. This receptor is represented by viewpoint 371.2.001 (views from residences on the B4118 Birmingham Road). Table 12.3.1 and Table 12.3.2 provide summaries of baseline information in respect of landscape and visual amenity, as relevant to the Proposed Development.

Table 12.3.1 Landscape baseline

Landscape Character Area (LCA)	Sensitivity	Description
Cole Valley LCA	Due to the fair condition, low tranquillity and regional value the sensitivity of the LCA is considered to be medium.	The LCA is characterised by contrasting land uses of agriculture, housing and industry across an area of former parkland. Within this area, industrial uses are limited to the Lakeside Industrial Park. The landform is a broad valley with areas of gently undulating terrain. It is crossed by the meandering and narrow River Cole and the M42, M6 and M6 Toll, which are heavily trafficked and lit at night. Additional transport routes which cross the LCA include the Birmingham and Derby line, Birmingham to Nuneaton line, National Grid overhead power lines and several roads linking to settlements, such as the B4114 Birmingham Road and Attleboro Lane. These transport routes and infrastructure elements heavily fragment the agricultural landscape. Additionally, agricultural land in the north is enclosed by the settlements of Coleshill, Gilson, Water Orton and Solihull. There is some intermittent built form, related to the former parkland, at Coleshill Manor (Grade II listed), Coleshill Hall Farm (Grade II listed) and Gilson Hall (Grade II listed) and several residences. There are two large linear woodland blocks within the grounds of Coleshill Manor, The Belt and The Catmore, which with the mature trees along the course of the River Cole, the transport

Landscape Character Area (LCA)	Sensitivity	Description
		corridors and hedgerow field boundaries, are key vegetation components within the LCA. The generally open and vegetated character of the agricultural areas contrasts with residential and industrial usages in the southern section of the LCA and with the surrounding settlements. There are a few PRoW which cross the LCA, mainly linking the surrounding settlements and crossing the motorway network via overbridges.
River Tame Flood Plain LCA	Due to the fair condition, regional value and medium tranquillity of the landscape, this LCA is judged to have high sensitivity to change.	This large area of green belt is set within a wide valley containing the M6 and A452, the Birmingham and Derby line and the meandering River Tame. The area also contains the private Minworth Sewage Treatment Works and Park Hall nature reserve. National Grid overhead power lines and transmission towers are also located throughout the landscape along with road and rail infrastructure such as gantries, overhead electrical lines and lighting. At night, light-spill from roads is evident in neighbouring areas. The LCA is heavily dissected and fragmented by road and rail corridors running in an east to west direction, the River Tame and fencing to private land boundaries. The nature reserve, a large area of remnant farmland and estate grounds, is heavily wooded, incorporating Langley Hill Wood, Parkhill Wood and Park Hall ancient woodland and a series of ponds and associated wetland habitats. Public access is restricted and is visually contained by the road and rail corridors. Castle Bromwich Scheduled Monument is also located within the LCA, but is inaccessible due to its proximity to the M6.
Farnborough Road Paddock and Open Space LCA	Due to the fair condition, local value and medium tranquillity of the landscape, this character area is judged to have medium sensitivity to change.	This LCA is defined by a medium-scale, multi-purpose, open space between the residential area of Castle Vale and the Birmingham and Derby line. The area includes allotments, the Castle Vale Nature Conservation Area, a small flood-lit football ground with associated lit car park, a skate park, disused paddocks, sports pitches and Plants Brook (a stream that runs adjacent to the Birmingham and Derby line). Vehicles are permitted in some parts of the open space to provide access to the allotments and the football ground. Footpaths within the open space are tarmac, and those within the nature conservation area have a loose stone surface. There are numerous types and heights of fence boundaries within the area. There are areas of close-mown grass within the open space and meadow grass within the paddocks and nature conservation area. There are isolated trees within the open grasslands and these form dense groups within the nature conservation area and to the interface with the railway line. The LCA is predominantly flat. Deciduous tree and shrub planting to the north of Plants Brook, along with the minimal topographical change, provides some screening of the railway line and its associated infrastructure during summer months.
Castle Bromwich Business Park LCA	Due to the poor condition, low value and low tranquillity of the landscape, this	Castle Bromwich Business Park LCA is a small character area, constituting medium-scale commercial and industrial units, National Grid overhead power lines and transmission towers and a hotel and pub restaurant, located to the immediate north of the M6 viaduct and River Tame. The Birmingham and Derby line is located

Landscape Character Area (LCA)	Sensitivity	Description
	character area is judged to have low sensitivity to change.	to the north of the business park. The commercial and industrial development, located to the east of the A452 Chester Road, is two to four storeys high, with a range of building styles and materials. The hotel development located to the west of the A452 Chester Road is a five storey brick building with a tiled roof. The business park has a main, narrow, circulatory road, which runs alongside the M6 viaduct, from which there are a number of narrow secondary routes providing access into individual plots. The units are not of a standardised scale, reflecting the changes in the built development over time. The built materials vary, including brick, concrete, corrugated and smooth metal cladding. There is a variety of boundary treatments. High level lighting is evident within car park areas whilst highway lighting is located along routes. Planting at boundaries is inconsistent and does not contribute to the public space. The hotel frontage along A452 Chester Road is relatively welcoming, with young trees and hedging shrubs, which help to integrate the development. Vegetation within the business park is more prominent at the interface with A452 Chester Road and adjacent to the M6 viaduct. The topography within the small character area has a minimal range and is consistent with the residential area to the north. Vegetation and elevated roads visually enclose the space.

Table 12.3.2 Visual baseline

Viewpoint	Sensitivity	Description
313.2.002 View south-west from residences along Attleboro Lane	High (includes view from residential properties)	Winter: The view is characterised by Attleboro Lane and bordering mature vegetation, lighting columns and telegraph poles in the foreground. Fields and hedgerows are in the middle ground, although largely filtered by vegetation along Attleboro Lane in the foreground. The vegetated embankments of the M42 are in the background, although largely filtered by the intervening vegetation. Summer: In summer, vegetation in the foreground almost entirely obscured the middle ground and background of the view. Night-time: In the foreground, Attleboro Lane is lit by street lighting columns, with light emanating from tall lighting columns along the M6/A452 in the background.
313.2.004 View south from residences on the Birmingham Road and Plank Lane	High (includes view from residential properties)	Winter: The view is characterised by Plank Lane and the roadside vegetation with partially filtered views of fields in the foreground. Fields divided by hedgerows with mature trees are in the middle ground. The vegetated embankments of the M42 are in the background although partially filtered by intervening vegetation. Summer: In summer, vegetation in the foreground and middle ground further screens views.
370.6.001 View north-west from Water Orton Road	Low (view from place of employment)	Winter: In the foreground of the view is the road bridge over the A452/M6, together with a road sign gantry and light columns, which are elements of urban clutter in the view. The horizon is dominated by established, predominantly deciduous, vegetation in the middle ground with transmission towers visible on the skyline beyond. The route of the

Viewpoint	Sensitivity	Description
adjacent to Park Hall College		Phase One scheme will pass through the landscape behind the vegetation in the middle ground. Summer: In summer, the existing established vegetation will screen views of the route of the Phase One scheme from this location. Night-time: At night the street lighting on B4118 Birmingham Road, A452 Chester Road and M6 passing beneath, together with that of the Prologis Park gives rise to sky-glow which reduces the perception of darkness within Park Hall nature reserve in between.
370.3.004 View north from the footpath through the open space overlooking the M6 corridor	High (includes recreational views)	Winter: An open area of grassland edged by woodland forms the foreground, which slopes north towards the A452 and M6. There are glimpsed views of the A452 and M6, including lighting columns, signs and gantries screened in places by intervening vegetation. The land falls away to the north of the M6 into the floodplain of the River Tame. The commercial and industrial buildings of Castle Bromwich Business Park are visible through the intervening vegetation. There are views of Minworth, Castle Vale and Tyburn in the middle ground. The distinctive Normanton, Fairbourne, Glendale and Kentimere residential tower blocks in Erdington are visible on what is predominantly a wooded skyline. The route of the Phase One scheme will lie in the middle ground, beyond the M6, transmission towers and woodland block in the centre of the view. Summer: In summer, the intervening vegetation screens and filters views of the A452 and M6. Night-time: At night the A452, M6 and Castle Bromwich Business Park are brightly lit by lighting columns. The residential areas of Castle Vale in the middle ground are also lit by street lighting. Park Hall nature reserve is unlit and is not visible due to intervening topography and vegetation.
370.2.006 Views north from residences on Park View	High (includes view from residential properties)	Winter: Wildflower grassland with recent tree planting forms the foreground of the view. A hedgerow runs down the left hand side of the view, between the park and the neighbouring Park Hall Academy. Lanchester Way runs down the right hand side. Lighting columns on Lanchester Way are visible against the sky. In the middle ground is an expanse of amenity grass with a multi-use games area and children's playground, with Bosworth's Wood to the right. The far edge of the park is delineated by a bank of mature trees and vegetation running parallel with the A452. In the background of the view, the lighting columns along the A452 and M6 can be seen, together with motorway gantry signs. A line of National Grid overhead power lines and transmission towers is a prominent feature on the wooded skyline in the background. The route of the Phase One scheme will be parallel to and just beyond the M6 and will be obscured by intervening topography and vegetation. Summer: In summer, views of the lighting and signage on the A452 and M6 are heavily filtered and partially screened by the intervening vegetation. Night-time: At night Lanchester Way is lit by streetlights, but the park is unlit. The A452 and M6 are well lit.

Viewpoint	Sensitivity	Description
370.2.007 Partial view north-east from residences on Chadshunt Close	High (includes view from residential properties)	Winter: The view (illustrated in Figure 30) is characterised by two storey terraced housing to the right, semi-detached bungalows to the left, boundary fences and open space/gardens and a central public footpath and street light. A tarmac road and PRoW are located in the foreground of the view, and the background is terminated by a timber post and rail fence and a belt of semi-mature vegetation. The route of the Phase One scheme will be in the background of the view and will be obscured by intervening topography and vegetation. Summer: A substantial belt of semi-mature vegetation in the background screens the A452 and M6 in summer. Night-time: A substantial belt of semi-mature vegetation in the background screens the A452 and M6 in summer.
371.2.001 Views west and south from residences on the B4118 Birmingham Road	High (includes view from residential properties)	Winter: Looking west, the view is characterised by highway fencing and hedgerows in the foreground and an open expanse of horse paddocks in the middle ground. The background is formed by the mature trees of Park Hall Wood, with National Grid overhead power lines and transmission towers on the skyline. The route of the Phase One scheme will be in the background of the view passing through Park Hall Wood and will be obscured by intervening topography and vegetation. Looking south, the view is likely to be characterised by the B4118 Birmingham Road and roadside vegetation in the foreground. Middle ground views are likely to partially filtered and of fields with hedgerows and the vegetated embankments of the M6. The upper sections of buildings within Smith's Wood are likely to be visible in the background. Summer: Looking west in summer, distant views are obscured by the intervening vegetation of Park Hall Wood and the roadside hedgerows. Looking south in summer, the vegetation in the foreground will further screen views. Night-time: Looking west at night, the B4118 Birmingham Road in the far left of the view is well lit by street lighting, with a night-time glow from the city of Birmingham to the south-west. Looking south at night, the view is lit by vehicles on the B4118 Birmingham Road / Water Orton Road, in both the foreground and middle ground of the view.
372.3.001 View north-west from the footpath near Pikehorne Croft overlooking the M6	High (includes recreational views)	Winter: The view is characterised by open grassland and framed by groups of trees and a woodland edge in the foreground, which gently slopes away towards the A452 and M6. Street lighting, National Grid overhead power line, transmission towers and a motorway gantry sign are clearly visible above the vegetation. The A452 and the traffic on it and M6 are clearly visible in the foreground. The middle ground is dominated by the trees and vegetation of the River Tame valley and Park Hall nature reserve, with a backdrop of warehouses and buildings within Midpoint Park. The background of the view is predominantly rural agriculture on gently rising hills to the north. The route of the Phase One scheme will be located in the middle ground, within the vegetation of the River Tame valley. Summer: In summer, views of the A452, M6 and associated lighting and fencing, are partially obscured and filtered by the intervening vegetation.

Viewpoint	Sensitivity	Description
		The vegetation in the middle ground also softens the hard lines of the Midpoint Park buildings. Night-time: At night, the A452 and M6 are well lit and there is lighting in the middle ground from the buildings and roads of Midpoint Park. Park Hall nature reserve appears as a dark, unlit area in the foreground.
372.2.002 Partial view north-west from residences on Blewitt Close through intervening vegetation	High (includes view from residential properties)	Winter: The view is characterised by mature trees in the foreground which filter views of the A452 and M6 to the north. In the middle ground is an open grassland area sloping towards the A452 and M6 corridor. The route of the Phase One scheme will lie in the River Tame valley beyond the M6 and there will be glimpsed views of the Phase One scheme through the intervening vegetation. Summer: In summer, views north towards the route of the Phase One scheme, the A452 and M6, and Castle Vale are obscured by intervening vegetation. Night-time: At night, the A452 and M6 are well lit by lighting columns, however, the open space in the foreground is unlit.
372.2.003 View north from residences at Musborough Close	High (includes view from residential properties)	Winter: The view is characterised by open rough grassland in the foreground, with a timber post and rail fence along the footpath to the south, and trees and vegetation to the north as the area slopes down towards the A452 and M6. The middle ground is dominated by the road corridor, with lighting columns, gantries, National Grid overhead power lines and transmission towers. Langley Hill Wood is clearly visible to the left of the view just beyond the M6. The background view is of Castle Vale residential areas and the Chivenor House tower block above the trees. The route of the Phase One scheme will be situated within the River Tame valley passing through Park Hall nature reserve. This area will be obscured from view here by intervening vegetation. Summer: In summer, the views of the A452 and M6, and much of Castle Vale beyond, are obscured by intervening vegetation. Night-time: At night, the foreground of the view is unlit, however, the A452, M6 and the residential areas of Castle Vale are well lit by street lighting.
372.3.004 View north-west from PRoW off Parkfield Drive overlooking M6 corridor	High (includes recreational views)	Winter: The view is characterised by open grassland bisected by Parkfield Drive as it approaches the junction with the A452. The PRoW continues west on the left of the view. Apart from at the junction, views of the A452 and M6 are screened by intervening vegetation. National Grid overhead power lines, transmission towers and street lighting are all prominent in the view. The buildings of Castle Bromwich Business Park in the middle ground are visible above the intervening vegetation. The Phase One scheme will pass through the middle ground of the view but will be largely obscured by intervening topography and vegetation. The background of the view extends across Castle Vale residential areas to the right and Tyburn industrial areas to the left. Summer: In summer, views of the A452, M6 and associated lighting and fencing, are further obscured and filtered by the intervening vegetation. The vegetation in the middle ground also softens the hard lines of the buildings of Castle Bromwich Business Park.

Viewpoint	Sensitivity	Description
		Night-time: At night, the A452 and M6 are well lit and there is lighting in the middle ground from the buildings of Castle Bromwich Business Park. The residential and industrial areas in the background add a bright array of light to the view.
373.3.001 View south from Castle Vale Nature Conservation Area (Farnborough Fields)	High (includes recreational views)	Winter: The view is characterised by open, rough, wet grassland in the foreground, with remnants of field boundary fencing. The middle ground is dominated by mature trees and hedgerows that follow the Birmingham and Derby line and the River Tame. On the right hand side of the middle ground are the floodlit sports pitches of The Vale Sports Club. National Grid overhead power lines and transmission towers dominate the background and horizon. The background is wooded, with limited views of the M6. The route of the Phase One scheme will pass through the middle ground, behind the mature trees and vegetation. Summer: In summer, views of the M6 are heavily filtered and screened by intervening vegetation. The existing railway is not visible. Night-time: At night, the foreground is unlit, with the exception of the playing fields, which are occasionally floodlit. The M6 is well lit, but intervening vegetation filters light spill.
373.2.002 View south-east from residences on Javelin Avenue across open space	High (includes view from residential properties)	Winter: The view is characterised by an open expanse of amenity grassland and sports pitches in the foreground, with a bound gravel path running parallel to Javelin Avenue. In the middle ground there are a number of fenced-off formal sports pitches and games areas associated with the Vale Sports Club. Behind these is a line of mature trees and Plants Brook, which flows into the River Tame. Beyond the Brook lies the Birmingham and Derby line, then the River Tame running parallel and Park Hall nature reserve. A line of National Grid overhead power lines and transmission towers is a prominent feature in the middle ground. In the background, amongst the wooded hillside, is the M6 with gantry signs, lighting columns and high-sided vehicles, which are glimpsed through the intervening vegetation. The route of the Phase One scheme will pass from the background into the middle ground to cross the River Tame and run parallel to the existing railway behind the trees. Summer: In summer, views of the M6 and the route of the Phase One scheme will be heavily filtered and partially obscured by intervening vegetation. Night-time: At night, there is street lighting to Javelin Avenue, floodlighting to some of the sports pitches in the middle ground, and the M6 and A452 are well lit by tall lighting columns. Park Hall nature reserve and the land around the River Tame are unlit and relatively dark.
373.3.003 View south from the north-western boundary of Farnboroug	High (includes recreational views)	Winter: The view is characterised by open amenity grassland and sports pitches in the foreground, with a line of semi-mature trees and shrubs partially screening the fence and hoardings surrounding the floodlit pitch of the Vale Sports Club in the middle ground. Transmission towers and floodlights are prominent features in the middle ground. Trains passing along the existing Birmingham and Derby line can be glimpsed through the vegetation behind The Vale Sports Club facilities. The background is dominated by dense woodland, which screens and heavily filters views of

Viewpoint	Sensitivity	Description
h Road Open Space		the M6, which is in an elevated position in this location. The route of the Phase One scheme will be located in the middle ground, obscured by intervening vegetation as it will pass behind The Vale Sports Club facilities, and parallel, but to the south of, the existing Birmingham and Derby line. Summer: In summer, the intervening vegetation screens views of the rail and will screen views of the Phase One scheme. Views of the M6 are also more heavily filtered, reduced to glimpses of high-sided vehicles and gantry signs. Night-time: At night, the foreground is unlit, with the exception of the playing fields, which are occasionally floodlit and the street lighting to the access road. The M6 corridor is well lit, but the intervening vegetation filters light spill.
373.2.004 View south-east from residences on Farnborough Road near Rawlins Croft	High (includes view from residential properties)	Winter: The view is characterised by a timber post and metal rail fenced horse grazing paddock with occasional groups of mature trees in the foreground. The middle ground is largely hidden by the hedgerow at the back of the paddock, but occasional trees are visible. A line of National Grid overhead power line and transmission towers is a prominent feature in the middle ground. The background is a heavily wooded hillside along which runs the M6 and also the A452 at a higher level. A blue motorway gantry sign and high-sided vehicles are clearly visible above the trees. The route of the Phase One scheme will pass into the middle ground of the view where it will be largely obscured by intervening vegetation. Summer: In summer, views of the M6 and the route of the Phase One scheme are heavily filtered and partially obscured by intervening vegetation. Night-time: At night, the M6 and A452 are well lit by tall lighting columns, with Park Hall nature reserve in the middle ground unlit and relatively dark.
373.3.006 View south-east from public open space off Park Lane, Castle Vale	High (includes recreational views)	Winter: The view is characterised by a ridge of undulating grassland, with scattered semi-mature trees in the foreground. The land slopes to either side; to the fenced boundary with the Birmingham and Derby line on the east and to the pedestrian knee rails along Park Lane to the west. There are lighting columns on Park Lane. A bound gravel path runs along the top of the ridge, and there is a standing stone sculpture at a focal point along the path that is visible in the centre of the view. The large warehouse buildings of Midpoint Park are visible above the trees along the railway and the edge of the Castle Vale residential estate is visible on the opposite side of Park Lane. The ground surface is only partially visible, due to the density of mature trees and vegetation. The Premier Paper building in Midpoint Park can be seen on the left above the vegetation, and the blue Betterware building above the roofs of the housing. The background of the view is heavily vegetated and includes distant views of Castle Bromwich. The route of the Phase One scheme will lie behind the middle ground, but views of this area are obscured by intervening vegetation and buildings.

Viewpoint	Sensitivity	Description
		Summer: In summer, the views towards the route of the Phase One scheme will be obscured by intervening vegetation. Night-time: At night, the residential area is well lit by street lighting and the lighting on the M6 can be seen in the distance.
373.4.007 View from the Derby and Birmingham train across Park Hall nature reserve	Low (transport view)	Winter: The view is characterised by the River Tame in the foreground and the open, wet grassland, occasional trees and shrubs, lakes, ponds and then woodland on rising ground towards the M6 in the middle ground. National Grid overhead power lines and transmission towers are prominent features in the middle ground. The background is the wooded edge to the A452 beyond the M6. The A452 and M6 are lit by lighting columns. The Phase One scheme will pass through Park Hall nature reserve into the floodplain and alongside the River Tame. Summer: In summer, the intervening vegetation filters and partially obscures views of the M6. Night-time: At night, Park Hall nature reserve is unlit, but the M6 and A452 are well lit by lighting columns.
373.7.008 View south from The Vale Sports Club pitches	Low (view from area of active sport)	Winter: The view is characterised by sports pitches surrounded by concrete panel fencing and a stadium building in the foreground. There is a belt of mature vegetation in the middle ground alongside Plants Brook and the existing Birmingham and Derby line. The background of the view is wooded as the land rises up to the south. There are glimpsed views of traffic on the M6 and blue motorway signs are also visible. The route of the Phase One scheme will be located in the middle ground, obscured by intervening vegetation as it will pass behind. The Vale Sports Club facilities, and parallel, but to the south of, the existing railway. Summer: In summer, mature trees in the middle ground of the view filter and partially obscure views of the M6 and the Birmingham and Derby line. Night-time: At night the sports pitches are occasionally floodlit but Park Hall nature reserve and the middle ground are unlit and dark. The lighting on the M6 and A452 is visible on the horizon.
375.2.001 Indirect views / direct views south from residences on Cadbury Drive	High (includes view from residential properties)	Winter: The view is characterised by dense vegetation in and around a brook (Dunlop Channel) that runs parallel to the Birmingham and Derby line. There is a metal railing fence with a gate through which there is a path running alongside the brook towards Farnborough Road Open Space in the east. The middle ground is occupied by the railway and Castle Bromwich Business Park, but views of these features are filtered by the dense foreground vegetation. The M6 in the background is glimpsed between the buildings and intervening vegetation. The route of the Phase One scheme will lie on the opposite side of the railway and will run through the edge of the Castle Bromwich Business Park. Summer: In summer, views of the M6 are almost entirely obscured by intervening vegetation and views of the business park and railway are heavily filtered and partially obscured.

Viewpoint	Sensitivity	Description
		Night-time: At night Cadbury Drive in the foreground is lit by street lights and the Castle Bromwich Business Park in the middle ground is well lit by bright, high level white lighting.
375.2.002 Indirect views / direct views south from residences on Clayton Walk off Cadbury Drive	High (includes view from residential properties)	Winter: The view is characterised by a residential street in the foreground with wide grass verges back-dropped by mature trees and vegetation. National Grid overhead power lines and transmission towers are present in the middle ground, with views of the railway and business park heavily filtered and screened by the intervening vegetation. Views of the M6 viaduct in the background are heavily screened by the intervening vegetation and the buildings of the business park. The route of the Phase One scheme will run parallel to the existing railway in the middle ground. Summer: In summer, views of the railway and business park are almost entirely obscured by the dense intervening vegetation. Night-time: At night Cadbury Drive in the foreground is lit by street lights and the Castle Bromwich Business Park in the middle ground behind the tree belt is well lit by bright, high level white lighting.
375.2.004 View south from residences on Javelin Avenue in front of residential properties	High (includes view from residential properties)	Winter: The view is characterised by close mown grass in the recreational open space in the foreground, with the informal, more natural landscape of the River Tame valley beyond in the middle ground. On the horizon is Langley Hill Wood and to either side it is possible to glimpse views of the M6 on higher ground through the intervening vegetation. Trains are visible passing along the Birmingham and Derby line behind the hedgerow vegetation in the foreground. The route of the Phase One scheme will be located between the railway, the National Grid overhead power line and transmission towers in the middle ground. Summer: In summer, the intervening vegetation partially screens and filters views of trains on the railway and vehicles on the M6. Night-time: Park Hall nature reserve in the middle ground of the view is not lit at night, but there is lighting on the M6 and A452 road corridor in the distance and localised street lighting in the foreground.
375.6.005 Channelled view south from Chivenor Primary School down Cadbury Drive	Low (view from place of employment)	Winter: The view is characterised by a residential street in the foreground with wide grass verges back-dropped by mature trees and vegetation. National Grid overhead power lines and transmission towers are present in the middle ground, with views of the railway and business park heavily filtered and screened by the intervening vegetation. Views of the M6 viaduct in the background are heavily screened by the intervening vegetation and the buildings of the business park. The route of the Phase One scheme will run parallel to the existing railway in the middle ground. In summer, views of the railway and business park are almost entirely obscured by the dense intervening vegetation. At night Cadbury Drive in the foreground is lit by street lights and the Castle Bromwich Business Park in the middle ground behind the tree belt is well lit by bright, high level white lighting. Summer: In summer, views beyond the middle ground are obscured by the mature trees along the railway.

Viewpoint	Sensitivity	Description
		Night-time: At night the area is well lit by street lamps and lighting in the Castle Bromwich Business Park.
375.2.006 View south-east from residences on Farnborough Road across the open space	High (includes view from residential properties)	Winter: The view is characterised by the wide street, with semi-mature street trees and pavements set in broad grass verges in the foreground and the expansive green of the Farnborough Road open space and paddock, with groups of semi-mature trees, in the middle ground. Beyond the open space is the Vale Sports Club building and floodlit football pitch. The background of the view is heavily vegetated, with mature predominantly deciduous trees and shrubs in the area rising up from Park Hall Wood towards Lanchester Park. The M6 and its gantry signs are clearly visible in the background. The route of the Phase One scheme will run parallel to the existing Birmingham and Derby line just beyond the middle ground, obscured by intervening vegetation. Summer: In summer, the dense vegetation of the River Tame valley screens the existing railway and the route of the Phase One scheme from view. Night-time: At night, Farnborough Road is well lit by light columns, the sports pitches associated with the Vale Sports facilities are floodlit and the M6 and A452 in the background are also well lit. Park Hall nature reserve is unlit and relatively dark.

Future environmental baseline

Construction

12.3.2 Planning permission has been granted for new residential properties along Birmingham Road, Water Orton, which constitute committed developments. These receptors are represented by Viewpoint 371.2.001 (views from residences on the B4118 Birmingham Road). Further to the 2017 Act, Water Orton Primary School has been relocated from a site off Vicarage Lane to a site off Plank Lane, Water Orton. The relocated Water Orton Primary School is represented by Viewpoint 313.2.004 (view from residences on the Birmingham Road and Plank Lane). Other committed developments identified in Section 2 of this report would not alter baseline information in respect of landscape and visual amenity.

Operation

12.3.3 The future baseline for operation is as for construction, as set out above.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 Measures that have been incorporated into the CoCP to avoid or reduce landscape and visual effects during construction include the following:

- maximising the retention and protection of existing trees and vegetation;
- use of well-maintained hoardings and fencing generally along the length of the construction boundary, and particularly in the vicinity of the proposed Bromford tunnel portal and intermediate shaft works;
- designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses in the vicinity of the proposed Bromford tunnel east portal works;
- appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed;

12.4.2 These measures have been taken account of in the assessment of the construction effects below.

Assessment of impacts and effects

12.4.3 Impacts and effects are summarised in Table 12.4.1 and Table 12.4.2, below. More detailed assessments of impacts and effects are provided inAppendix 12.1.

Table 12.4.1 Landscape effects, during construction, resulting from incorporation of the Proposed Development, as compared with those of the Phase One scheme

Landscape Character Area (LCA)	Construction
Cole Valley LCA	Phase One scheme: The 2013 ES, as amended, reported a moderate adverse, **significant**, effect on this LCA, due to construction activities occurring within the LCA, including vegetation removal, demolition of listed buildings, construction of viaducts, utilities works and river diversions. With Proposed Development: The construction activities set out above will continue to occur, along with activities including construction of Bromford tunnel east portal buildings, an auto-transformer station and a new substation. The partial loss and alteration to the agricultural character of the area and the removal of vegetation will result in a medium magnitude of change. The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect - **significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.
River Tame Flood Plain LCA	Phase One scheme: The 2013 ES, as amended, reported a major adverse, **significant**, effect on this LCA, due to construction activities occurring within the LCA, including vegetation removal, temporary realignment of B4118 Birmingham Road over the Phase One scheme, construction of the River Tame viaduct, overhead power line diversions and realignment of the River Tame. With Proposed Development: Temporary realignment of B4118 Birmingham Road, construction of the River Tame viaduct, overhead power line diversions and realignment of the River Tame will not be

Landscape Character Area (LCA)	Construction
	required. Construction will temporarily introduce activities, including access with corresponding vehicle and plant movements, ground monitoring works at locations along the route of Bromford tunnel, and a compound (off Water Orton Road). However, these activities would result in partial change to the landscape character of the area. The magnitude of change is, therefore, considered to be medium. The medium magnitude of change, assessed alongside the high sensitivity of the character area, will result in a moderate adverse effect - **significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect. A significant effect on the River Tame Flood Plain LCA would occur as a result of the Phase One scheme and the Proposed Development, however the level of effect would be reduced
Farnborough Road Paddock and Open Space LCA	Phase One scheme: The 2013 ES, as amended, reported a moderate adverse, **significant**, effect on this LCA, due to construction activities occurring within the LCA, including vegetation removal, together with indirect effects on the setting of the LCA due to works within the River Tame Flood Plain LCA. With Proposed Development: There will be no change to the character of the LCA or its setting as construction works will not occur in this LCA or notably alter its setting. The effect will be **not significant**. Taking into account the above considerations, the significant effect of the Phase One scheme would be removed as a result of the Proposed Development.
Castle Bromwich Business Park LCA	Phase One scheme: The 2013 ES, as amended, reported a moderate adverse, **significant**, effect on this LCA, due to construction activities including removal of vegetation to the south of the Birmingham and Derby line, the demolition of industrial buildings, and the construction of Bromford tunnel and portal. With Proposed Development: Construction activities include the demolition of industrial buildings together with construction of Bromford tunnel intermediate shaft and shaft building (headhouse). Overall, the magnitude of change is considered to be medium. The medium magnitude of change assessed alongside the low sensitivity of the character area, will result in a moderate adverse effect - **significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.

Table 12.4.2 Visual effects, during constriction, resulting from incorporation of the Proposed Development, as compared with those of the Phase One scheme

Viewpoint	Construction
313.2.002 View south-west from residences along Attleboro Lane	Phase One scheme: The 2013 ES, as amended, reported a major adverse, **significant**, effect due to construction activities including demolition of properties along Attleboro Lane, construction of a balancing pond, the formation of embankments, and construction of Attleboro Lane overbridge and flyover within the direct frame of the view. Night-time effects were considered to be **not significant** and no further assessment was carried out. With Proposed Development: The construction hoarding, new alignment of Attleboro Lane and proposed substation will be visible in the foreground of the view. Demolition of properties along Attleboro Lane, the formation of embankments, construction of Attleboro Lane overbridge and Attleboro flyover will be visible in the middle ground of the view. The construction of Bromford tunnel east portal, with portal buildings and an auto-transformer station, will be visible in the background of the view. As these activities will be within the direct frame of view the magnitude of change is high. The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect – **significant**. Given the presence of existing lighting along Attleboro Lane, in the foreground, and along the M6/A452 in the background, the effect at night will be **not significant**, and no further assessment is required. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.
371.2.001 Views west and south from residences on the B4118 Birmingham Road	Phase One scheme: Looking west, the 2013 ES, as amended, reported a medium magnitude of change due to construction activities (including construction of the B4118 Water Orton Road overbridge and use of the nearby construction compound), giving a moderate adverse effect - **significant**. Looking south, the 2013 ES, as amended, reported substantial change due to construction activities, compared to existing views of fields. However, the magnitude of change was considered to be medium, due to views being filtered by existing vegetation, giving a moderate adverse effect - **significant**. Given the presence of existing lighting along the B4118 in views looking west and south, effects at night were considered to be **not significant**. With Proposed Development: Looking west, the compound off Water Orton Road will be visible, partially filtered by intervening vegetation. Therefore, the magnitude of change is considered to be medium. The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect - **significant**. Looking south, temporary construction hoarding, the slurry treatment

Viewpoint	Construction
	area and the construction plant on the haul roads will be visible in the middle ground of the view. Also within the middle ground of the view, but viewed obliquely, will be the compound off Water Orton Road. The presence of these activities is considered to represent a substantial change compared to views of fields, however this will be filtered by existing vegetation. Therefore, the magnitude of change is considered to be medium. The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect - **significant**. Given the presence of existing lighting along the B4118 in views looking west and south, the magnitude of impact at night will be low. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse effect - **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.
313.2.004 View south from residences on the Birmingham Road and Plank Lane	Phase One scheme: The 2013 ES, as amended, reported minor alterations to existing views due to construction of the Phase One scheme, as a result of intervening vegetation restricting views of the Phase One scheme, such that effects were considered to be **not significant**. With Proposed Development: Minor or negligible alterations to existing views will occur due to construction of the Proposed Development, as a result of intervening vegetation restricting views of the Proposed Development, such that effects will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.
370.6.001 View north-west from Water Orton Road adjacent to Park Hall College; 370.3.004 View north from the footpath through the open space overlooking the M6 corridor; 370.2.006 Views north from residences on Park View; 370.2.007 Partial view north-east from residences on Chadshunt Close; 372.3.001 View north-west from the footpath near Pikehorne Croft overlooking the M6; 372.2.002 Partial view north-west from residences on Blewitt Close through intervening vegetation; 372.2.003 View north from residences at Musborough Close; 372.3.004 View north-west from PRoW off Parkfield Drive overlooking M6 corridor; 373.3.006 View south-east from public open space off Park Lane, Castle Vale;	Phase One scheme: The 2013 ES, as amended, reported minor alterations to existing views due to construction of the Phase One scheme, resulting in **not significant** effects. With Proposed Development: Minor or negligible alterations to existing views will occur due to construction of the Proposed Development, resulting in **not significant** effects. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.

Viewpoint	Construction
373.7.008 View south from The Vale Sports Club pitches	
373.3.001 View south from Castle Vale Nature Conservation Area (Farnborough Fields); 373.2.002 View south-east from residences on Javelin Avenue across open space; 373.3.003 View south from the north-western boundary of Farnborough Road Open Space; 373.2.004; View south-east from residences on Farnborough Road near Rawlins Croft; 373.4.007; View from the Derby and Birmingham train across Park Hall nature reserve; 375.2.004 View south from residences on Javelin Avenue in front of residential properties; 375.2.006 View south-east from residences on Farnborough Road across the open space	Phase One scheme: The 2013 ES, as amended, reported moderate adverse, **significant**, effects due to construction activities, including power line diversions and construction of the River Tame viaduct. With Proposed Development: Limited construction activity will occur in the vicinity of these views such that negligible alterations to existing views will occur due to construction of the Proposed Development, resulting in **not significant** effects. Taking into account the above considerations, the significant effect of the Phase One scheme would be removed as a result of the Proposed Development.
375.2.001 Indirect views / direct views south from residences on Cadbury Drive; 375.2.002 Indirect views / direct views south from residences on Clayton Walk off Cadbury Drive; 375.6.005 Channelled view south from Chivenor Primary School down Cadbury Drive	Phase One scheme: The 2013 ES, as amended, reported **significant** (viewpoints 375.2.001 and 375.2.002) and **not significant** (viewpoint 375.6.005) effects due to construction activities. Given the presence of existing lighting, effects at night were assessed as **not significant** and no further assessment of night-time effects was undertaken. Proposed Development: Views of construction activities will be filtered by intervening vegetation in the foreground of the view, allowing only glimpsed views of the demolition of buildings on Castle Bromwich Business Park together with construction activities associated with Bromford tunnel shaft and building (headhouse). The magnitude of change is considered to be negligible. The negligible magnitude of change assessed alongside the high sensitivity of the receptors will result in a negligible adverse effect - **not significant**. Night-time effects: Works will be 24 hour and lit during the hours of darkness. This will appear against the backdrop of the existing well-lit Castle Bromwich Business Park. Given the presence of existing lighting, the effects at night will be **not significant** and no further assessment of night-time effects is required. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.

Other mitigation and residual effects

12.4.4 As no other mitigation measures are considered practicable or necessary, the likely residual significant effects remain as reported above.

Cumulative effects

12.4.5 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

12.5 Effects arising during operation

Avoidance and mitigation measures

12.5.1 A process of iterative design and assessment has been employed to avoid or reduce adverse effects during the operation of the Proposed Development. Measures that have been incorporated into the design of the Proposed Development include:

- the adoption of a green infrastructure approach to the design of the landscape environment within the Proposed Development to ensure the creation of a well-connected landscape that helps to alleviate flooding, and benefit biodiversity and recreation;
- embankment and cuttings, both for the railway and highway alignments, have been shaped so as to integrate the Proposed Development into the character of the surrounding landscape;
- planting, including native trees/woodland, shrubs and hedgerows, to screen the new railway and ancillary infrastructure from neighbouring residences and users of adjacent PRoW, and to aid integration of the Proposed Development into the landscape; and
- selection of species will reflect tree and shrub species native to the area and take into account possible climate change impacts associated with the quality and availability of water and the potential increase in pests and diseases.

12.5.2 Specific design measures to aid in integrating the Proposed Development within the landscape include landscape proposals (landscape mitigation planting and landscape earthworks) at Bromford tunnel east portal and the electrical substation.

Assessment of impacts and effects

12.5.3 Impacts and effects are summarised in Table 12.5.1 and Table 12.5.2, below. More detailed assessments of impacts and effects are provided in Appendix 12.1.

Table 12.5.1 Landscape effects, during operation, resulting from incorporation of the Proposed Development, as compared with those of the Phase One scheme

Landscape Character Area (LCA)	Operation – Year 1,	Operation – Year 15	Operation – Year 60
Cole Valley LCA	Phase One scheme: The 2013 ES, as amended, reported a moderate adverse, **significant** effect on this LCA, due to the introduction of a new transport corridor with associated infrastructure, including viaducts, embankments, noise barriers, overhead line equipment and realignment of Attleboro Lane. With Proposed Development: The operational elements set out above will continue to occur, along with the introduction of elements including Bromford tunnel east portal buildings, an auto-transformer station and a new substation. Given existing infrastructure within the setting of the operational proposals there would be a partial loss to landscape character, the magnitude of change is considered to be medium in year 1 of operation. 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 - **significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported a minor adverse, **not significant** effect, as by year 15 proposed planting will soften and reduce the mass and scale of proposed infrastructure. With Proposed Development: The effects will be as set out above. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported a minor adverse, **not significant** effect, as by year 60 planting will have matured and further replicate the woodland character of the area, however there would remain a minor alteration to the landscape. With Proposed Development: The effects will be as set out above. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.
River Tame Flood Plain LCA	Phase One scheme: The 2013 ES, as amended, reported a moderate adverse, **significant** effect on this LCA, due to the introduction of a new transport corridor with associated infrastructure, including the River Tame viaduct.	Phase One scheme: The 2013 ES, as amended, reported that by year 15, the magnitude of change will remain unchanged – moderate adverse, **significant**.	Phase One scheme: The 2013 ES, as amended, reported that by year 60 the magnitude of change will remain unchanged – moderate adverse, **significant**.

Landscape Character Area (LCA)	Operation – Year 1,	Operation – Year 15	Operation – Year 60
	With Proposed Development: The route will enter the LCA at B4118 Birmingham Road, east to west, in Bromford tunnel, and will remain in Bromford tunnel before exiting this character are at Castle Bromwich Business Park. Upon restoration of temporary construction working areas and compounds, the magnitude of change is considered to be negligible in year 1 of operation. The negligible magnitude of change, assessed alongside the high sensitivity of the character area, will result in a negligible adverse effect in year 1 of operation – **not significant**. Taking into account the above considerations, significant effect of the Phase One scheme would be removed as a result of the Proposed Development.	With Proposed Development: By year 15, there will be no change to the character of the LCA or its setting. The effect will be **not significant**. Taking into account the above considerations, the significant effect of the Phase One scheme would be removed as a result of the Proposed Development.	With Proposed Development: By year 60, there will be no change to the character of the LCA or its setting. The effect will be **not significant**. Taking into account the above considerations, the significant effect of the Phase One scheme would be removed as a result of the Proposed Development.
Farnborough Road Paddock and Open Space LCA	Phase One scheme: The 2013 ES, as amended, reported a minor adverse, **not significant**, effect on this LCA, due to the effect of vegetation removal. With Proposed Development: There will be no change to the character of the LCA or its setting. The effect will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported that due to the maturing of proposed planting, there will be a negligible adverse, **not significant**, effect on this LCA. With Proposed Development: There will be no change to the character of the LCA or its setting. The effect will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported there will be no change to the character of the LCA or its setting. This would result in a **not significant** effect. With Proposed Development: With Proposed Development: The effects will be as set out above. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.
Castle Bromwich Business Park LCA	Phase One scheme: The 2013 ES, as amended, reported a	Phase One scheme: The 2013 ES, as amended,	Phase One scheme: The 2013 ES, as amended,

Landscape Character Area (LCA)	Operation – Year 1,	Operation – Year 15	Operation – Year 60
	minor adverse, **not significant**, effect on this LCA, due to vegetation removal. With Proposed Development: The character of Castle Bromwich Business Park will remain intact and therefore there would be no change to the character of the LCA or its setting. The effect will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	reported that operational effects will reduce from minor adverse to negligible, **not significant**, because of the change in character and setting arising from the maturity of the Phase One scheme planting. With Proposed Development: The character of Castle Bromwich Business Park will remain intact and therefore there would be no change to the character of the LCA or its setting. The effect will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	reported there will be no change to the character of the LCA or its setting. This would result in a **not significant** effect. With Proposed Development: With Proposed Development: The effects will be as set out above. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.

Table 12.5.2 Visual effects, during operation, resulting from incorporation of the Proposed Development, as compared with those of the Phase One scheme

Viewpoint	Operation – Year 1, Winter	Operation – Year 1, Summer	Operation – Year 15, Summer	Operation – Year 60, Summer
313.2.002 View south-west from residences along Attleboro Lane	Phase One scheme: The 2013 ES, as amended, reported a moderate adverse, **significant**, effect due to the presence of new infrastructure in the view, including a balancing pond, new planting, realigned Attleboro Lane, and Attleboro Lane overbridge and flyover, which would be filtered	Phase One scheme: The 2013 ES, as amended, reported a moderate adverse, **significant**, effect as views of the elevated sections of the Phase One scheme will remain as per winter. With Proposed Development: In summer of year 1, views will remain as per winter, therefore the	Phase One scheme: The 2013 ES, as amended, reported that by year 15 the effect will remain moderate adverse, **significant**, as planting will have established but not sufficiently to filter views of the elevated sections of the Phase One scheme. With Proposed Development: by year 15 the effect	Phase One scheme: The 2013 ES, as amended, reported that by year 60 the planting will have matured and will almost entirely obscure views of the Phase One scheme such that the effect will be negligible adverse, **not significant**. With Proposed Development: By year 60 the

Viewpoint	Operation – Year 1, Winter	Operation – Year 1, Summer	Operation – Year 15, Summer	Operation – Year 60, Summer
	by vegetation along Attleboro Lane. With Proposed Development: New planting, the realigned Attleboro Lane and the proposed substation will be visible in the foreground of the view. The embankments of the Attleboro Lane overbridge, Attleboro flyover and earthworks of Marsh Lane embankment will be visible in the middle ground of the view. Bromford tunnel east portal buildings and auto-transformer station will be visible in the background. Vegetation along Attleboro Lane will partially filter views and therefore the magnitude of change is medium. 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 - **significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different	magnitude of change is considered to remain medium, meaning the overall effect (moderate adverse, **significant**) will be unchanged. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	will remain moderate adverse, **significant**, as planting will have established but not sufficiently to filter views of the elevated sections of the Phase One scheme. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	planting will have matured and will almost entirely obscure views of the Proposed Development. Therefore, the magnitude of change will be negligible. The negligible magnitude of change, assessed with the high sensitivity of the receptor, will result in a negligible adverse effect, which is **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.

Viewpoint	Operation – Year 1, Winter	Operation – Year 1, Summer	Operation – Year 15, Summer	Operation – Year 60, Summer
	significant adverse effect.			
371.2.001 Views west and south from residences on the B4118 Birmingham Road	Phase One scheme: Looking west, the 2013 ES, as amended, reported that the Phase One scheme will be predominantly hidden from view in deep cutting with only the Water Orton over bridge and boundary fencing visible through intervening vegetation. Looking south, the 2013 ES, as amended, reported that the Phase One scheme will be located in the middle ground of views and largely filtered by intervening vegetation. Effects were considered to be minor adverse - **not significant**. With Proposed Development: Looking west and south, the Proposed Development will be hidden from view in tunnel (Bromford tunnel). Therefore, no further assessment is required. Effects will be **not significant**. Taking into account the above considerations, the Proposed Development will	Phase One scheme: Looking west, the 2013 ES, as amended, reported that Water Orton over bridge and fencing will be partially visible through intervening vegetation, resulting in negligible effects – not significant; looking south during summer, effects were considered to remain as per winter – minor adverse, **not significant**. With Proposed Development: There will be no change to the assessment during summer operation year 1. Effects will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported negligible effects due to intervening vegetation and new planting – **not significant**. With Proposed Development: There will be no change to the assessment during summer operation year 15. Effects will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported no change to the assessment during summer operation year 60. Effects will be **not significant**. With Proposed Development: There will be no change to the assessment during summer operation year 60. Effects will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.

Viewpoint	Operation – Year 1, Winter	Operation – Year 1, Summer	Operation – Year 15, Summer	Operation – Year 60, Summer
	not give rise to a new or different significant adverse effect.			
313.2.004 View south from residences on the Birmingham Road and Plank Lane	Phase One scheme: The 2013 ES, as amended, reported minor alterations to existing views, as a result of intervening vegetation restricting views of the Phase One scheme. Effects were assessed as **not significant**. Proposed Development: Minor alterations to existing views will occur, as a result of intervening vegetation restricting views of the Proposed Development. Effects will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported negligible alterations to existing views, as a result of intervening vegetation restricting views of the Phase One scheme. Effects were assessed as **not significant**. Proposed Development: Negligible alterations to existing views will occur, as a result of intervening vegetation restricting views of the Proposed Development. Effects will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported no further assessment required – **not significant** With Proposed Development: No further assessment required – **not significant** Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme: The 2013 ES, as amended, reported no further assessment required – **not significant** With Proposed Development: No further assessment required – **not significant** Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.
370.6.001 View north-west from Water Orton Road adjacent to Park Hall College; 370.3.004 View north from the footpath through the open space	Phase One scheme: The 2013 ES, as amended, reported minor alterations to existing views due to operation of the Phase One scheme, resulting	Phase One scheme: The 2013 ES, as amended, reported minor/negligible alterations to existing views or no change to existing views due to operation of the	Phase One scheme: The 2013 ES, as amended, reported minor/negligible alterations to existing views or no change to existing views due to operation of the	Phase One scheme: The 2013 ES, as amended, reported minor/negligible alterations to existing views or no change to existing views due

Viewpoint	Operation – Year 1, Winter	Operation – Year 1, Summer	Operation – Year 15, Summer	Operation – Year 60, Summer
overlooking the M6 corridor; 370.2.006 Views north from residences on Park View; 370.2.007 Partial view north-east from residences on Chadshunt Close; 372.3.001 View north-west from the footpath near Pikehorne Croft overlooking the M6; 372.2.002 Partial view north-west from residences on Blewitt Close through intervening vegetation; 372.2.003 View north from residences at Musborough Close; 372.3.004 View north-west from PRoW off Parkfield Drive overlooking M6 corridor; 373.3.006 View south-east from public open space off Park Lane, Castle Vale; 373.7.008 View south from The Vale Sports Club pitches	in **not significant** effects. With Proposed Development: The Proposed Development will be hidden from view in tunnel (Bromford tunnel), resulting in no effects, which are **not significant**. Therefore, no further assessment is required. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme, resulting in **not significant** effects. With Proposed Development: There will be no change to the assessment during summer operation year 1 (**not significant**). Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Phase One scheme, resulting in **not significant** effects. With Proposed Development: There will be no change to the assessment during summer operation year 1 (**not significant**). Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	to operation of the Phase One scheme, resulting in **not significant** effects. With Proposed Development: There will be no change to the assessment during summer operation year 1 (**not significant**). Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.
373.3.001 View south from Castle Vale Nature Conservation Area (Farnborough Fields); 373.2.002 View south-east from residences on Javelin Avenue across open space; 373.3.003 View south from the	Phase One scheme: The 2013 ES, as amended, reported alterations to existing views due to visibility of the above ground operational railway (including the River Tame viaduct), resulting in **significant** and	Phase One scheme: The 2013 ES, as amended, reported alterations to existing views due to visibility of the above ground operational railway (including the River Tame viaduct), resulting in **significant** and	Phase One scheme: The 2013 ES, as amended, reported alterations to existing views due to visibility of the above ground operational railway (including the River Tame viaduct), resulting in **significant** and	Phase One scheme: The 2013 ES, as amended, reported alterations to existing views due to visibility of the above ground operational railway (including the River Tame viaduct), resulting

Viewpoint	Operation – Year 1, Winter	Operation – Year 1, Summer	Operation – Year 15, Summer	Operation – Year 60, Summer
north-western boundary of Farnborough Road Open Space; 373.2.004; View south-east from residences on Farnborough Road near Rawlins Croft; 373.4.007; View from the Derby and Birmingham train across Park Hall nature reserve; 375.2.004 View south from residences on Javelin Avenue in front of residential properties; 375.2.006 View south-east from residences on Farnborough Road across the open space	**not significant** effects. With Proposed Development: The Proposed Development will be hidden from view in tunnel (Bromford tunnel), resulting in no effects, which are **not significant**. Therefore, no further assessment is required. Taking into account the above considerations, the significant effects of the Phase One scheme would be removed as a result of the Proposed Development.	**not significant** effects. With Proposed Development: The Proposed Development will be hidden from view in tunnel (Bromford tunnel), resulting in no effects, which are **not significant**. Therefore, no further assessment is required. Taking into account the above considerations, the significant effects of the Phase One scheme would be removed as a result of the Proposed Development.	**not significant** effects. With Proposed Development: The Proposed Development will be hidden from view in tunnel (Bromford tunnel), resulting in no effects, which are **not significant**. Therefore, no further assessment is required. Taking into account the above considerations, the significant effects of the Phase One scheme would be removed as a result of the Proposed Development.	in **significant** and **not significant** effects. With Proposed Development: The Proposed Development will be hidden from view in tunnel (Bromford tunnel), resulting in no effects, which are **not significant**. Therefore, no further assessment is required. Taking into account the above considerations, the significant effects of the Phase One scheme would be removed as a result of the Proposed Development.
375.2.001 Indirect views / direct views south from residences on Cadbury Drive; 375.2.002 Indirect views / direct views south from residences on Clayton Walk off Cadbury Drive; 375.6.005 Channelled view south from Chivenor Primary School down Cadbury Drive	Phase One scheme: The 2013 ES, as amended, reported alterations to existing views due to visibility of the above ground operational railway components, resulting in **not significant** effects. Proposed Development: Visibility will be restricted to glimpses of the shaft building (headhouse) with views heavily filtered by mature vegetation	Phase One scheme: The 2013 ES, as amended, reported alterations to existing views due to visibility of the above ground operational railway components, resulting in **not significant** effects. Proposed Development: There will be no change to the assessment during summer operation year 1. The effects will be **not significant**.	Phase One scheme: The 2013 ES, as amended, reported alterations to existing views due to visibility of the above ground operational railway components, resulting in **not significant** effects. Proposed Development: There will be no change to the assessment during summer operation year 1. The effects will be **not significant**.	Phase One scheme: The 2013 ES, as amended, reported alterations to existing views due to visibility of the above ground operational railway components, resulting in **not significant** effects. Proposed Development: There will be no change to the assessment during summer operation year 1.

Viewpoint	Operation – Year 1, Winter	Operation – Year 1, Summer	Operation – Year 15, Summer	Operation – Year 60, Summer
	alongside the existing Birmingham and Derby line. The magnitude of change is considered to be negligible. The negligible magnitude of change assessed alongside the high sensitivity of the receptor will result in negligible adverse effect - **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.	The effects will be **not significant**. Taking into account the above considerations, the Proposed Development will not give rise to a new or different significant adverse effect.

Other mitigation and residual effects

12.5.4 As no other mitigation measures are considered practicable, the likely residual significant effects remain as reported above.

Cumulative effects

12.5.5 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

12.6 Summary

12.6.1 In terms of landscape and visual amenity, no new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme. The Proposed Development would result in alternative infrastructure, and construction thereof, near Water Orton, however with the corresponding mitigation in place (including appropriate landscape proposals) the significance of landscape and visual effects would be comparable with those reported in the 2013 ES, as amended. In the case of the Phase One scheme and

the Proposed Development, although there would be significant effects during construction, during operation effects would diminish to not significant due to the establishment of landscape planting mitigation proposals. Between Water Orton and Castle Bromwich Business Park, the landscape and visual effects resulting from incorporation of the Proposed Development would generally be reduced, and in many cases removed, compared with the Phase One scheme (which included the River Tame viaduct in this area). This is because infrastructure would be primarily located underground, within the extended tunnel, such that it would not result in significant landscape and visual effects during operation and the Proposed Development would provide an improvement in these respects, compared with Phase One scheme. At Castle Bromwich Business Park, landscape and visual effects resulting from incorporation of the Proposed Development would be comparable with, or reduced, compared with the Phase One scheme; again, the Proposed Development would provide an improvement compared with the Phase One scheme.

13 Major accidents and natural disasters

13.1 Introduction

13.1.1 This section presents the assessment of the likely significant environmental effects arising directly from the Proposed Development if it were to be affected by a major accident and/or natural disaster. The assessment of the vulnerability of the Proposed Development to major accidents and natural disasters is included in this screening report following changes to EU and UK legislation during 2017, when the requirement was brought into force by the 2017 EIA Regulations. In the transposition between EU and UK legislation the word 'natural' has been omitted to ensure that both manmade and natural disasters are considered. As this was not a requirement at the time the 2013 ES, as amended, was published, an assessment of major accidents and disasters was not included.

13.1.2 The underlying objective of the assessment is to ensure that appropriate precautionary actions are taken for those projects that are likely to have significant adverse effects on the environment due to the project's vulnerability to major accidents and/or disasters.

13.2 Scope, assumptions and limitations

13.2.1 As the 2013 ES, as amended, did not include this topic, the screening assessment presented in this report will be based on the assessment scope, key assumptions and limitations for the major accidents and disasters assessment set out in the HS2 Phase Two environmental statements, including the High Speed Rail (West Midlands – Crewe) Environmental Statement ("the Phase 2a ES"), and the High Speed Rail (Crewe to Manchester and West Midlands to Leeds) Working Draft Environmental Statement ("the Phase 2b Draft ES"). The assessment approach in these two documents is consistent, however because the Phase 2b Draft ES is a working draft, the Phase 2a ES (Volume 3: Route-wide effects, Volume 5: Scope and Methodology Report (SMR), the SMR Addendum, and Volume 5: Appendix MA-001-000) contains a more complete assessment and forms the primary reference point for major accidents and disasters in relation to this screening assessment.

13.2.2 The assessment considers those unplanned events or situations that have been determined as being relevant to the Phase One scheme and Proposed Development, are considered to be major in scale and have been identified as having the potential to result in any significant adverse environmental effects.

13.2.3 To inform the assessment for the Phase 2a ES, the following documents were reviewed to identify and consolidate risks into major accident and disaster 'risk events', to which the Phase 2a scheme is considered vulnerable:

- Phase 2a Construction, Design and Management (CDM) risk registers (live working documents at the time of Phase 2a ES writing). These registers are required under the Construction (Design and Management) ((CDM) 2015 Regulations, placing specific duties on clients, designers and contractors, so that health and safety is taken into account throughout the life of a construction project from its inception to its subsequent final demolition and removal; and,
- HS2 Ltd's System Safety Hazard Record (live working documents at the time of Phase 2a ES writing), which demonstrates HS2 Ltd's approach to ensuring operational safety through delivering a reliable and resilient railway system, delivering an effective design process, and effective, progressive systems assurance, robust verification and validation of Systems Safety Requirements within the design, delivery and handover phases.

13.2.4 The risk events identified in Phase 2a ES Volume 5: Appendix MA-001-000 have been reviewed alongside the documents listed below to inform the major accidents and disasters assessment for this screening report:

- HS2 Phase One CDM Risk Register (live working document at the time of writing this screening report). These registers are required under the Construction (Design and Management)(CDM) 2015 Regulations, placing specific duties on clients, designers and contractors, so that health and safety is taken into account throughout the life of a construction project from its inception to its subsequent final demolition and removal; and,
- HS2 Ltd's System Safety Hazard Record (live working document at the time of writing this screening report), which demonstrates HS2 Ltd's approach to ensuring operational safety through delivering a reliable and resilient railway system, delivering an effective design process, and effective, progressive systems assurance, robust verification and validation of Systems Safety Requirements within the design, delivery and handover phases.

13.2.5 In summary, the methodology for the Phase 2a ES identified risk events relevant to the scheme, screened the risk events as to whether they constitute a major accident or disaster (as defined by the Volume 5 SMR Addendum, Appendix CT-001-002 of the Phase 2a ES), defined the impact, assessed the likelihood and then assessed the risk. This screening assessment has followed the same approach by using the HS2 Phase One documents relevant to the Proposed Development, identified above, to review and update the list of risk events, screen the risk events, define the impact, assess the likelihood and then assess

the risk. The full list of risk events, updated by the Phase One documents, is presented in Appendix 13.1.

13.2.6 Key terms used in this assessment topic are defined in Table 13.2.1.

Table 13.2.1 Key definitions relevant to this assessment topic

Term	Definition
ALARP	As Low As Reasonably Practicable
CSM-RA	Common Safety Method (Risk Assessment)
Environmental receptor	Features of the environment that are subject to assessment, namely population and human health, biodiversity, land, soil, water, air and climate, material assets, cultural heritage and landscape. These are categorised consistently with the EIA structure.
Major accident	A major accident, in the context of the Proposed Development, is an event or situation that threatens immediate or delayed serious damage to human health, welfare and/or the environment and requires the use of resources beyond those of HS2 Ltd or its contractors. Serious damage includes the loss of life or permanent injury and/or permanent or long-lasting damage to an environmental receptor that cannot be restored through minor clean-up and restoration efforts
Natural disaster	A naturally occurring phenomenon such as an extreme weather event (storm, flood, temperature) or ground-related hazard events (subsidence, landslide, earthquake) with the potential to cause an event or situation that meets the definition of a major accident above
Reasonable worst-case environmental effect	A challenging manifestation of the consequence(s) of a risk event occurring, after highly implausible or less significant consequences are excluded.
Risk	The likelihood of an impact occurring, combined with effect or consequence(s) of the impact on a receptor if it does occur.
Risk Event	An identified, unplanned event, which is considered relevant to the Proposed Development and has the potential to be a major accident or disaster subject to assessment of its potential to result in a significant adverse effect on an environmental receptor.
Serious damage	Serious damage includes the loss of life, permanent injury and temporary or permanent destruction of an environmental receptor.
Vulnerability	In the context of this assessment, the term refers to the 'exposure and resilience' of the Proposed Development to the risk of a major accident and/or disaster. Vulnerability is influenced by sensitivity, adaptive capacity and magnitude of impact.

13.3 Environmental Baseline

Existing baseline

13.3.1 The baseline for the Phase 2a ES was established by considering the baseline components presented in Table 13.3.1, on a route-wide basis, with respect to each of the environmental topics of the Phase 2a ES. The same baseline components are considered to be relevant across the HS2 scheme, and

therefore have been considered with respect to identifying relevant adverse effects of the Proposed Development.

Table 13.3.1 Baseline components relevant to this assessment topic

Baseline Component	Description
Features external to the Proposed Development that contribute a potential source of hazard to the Proposed Development	As far as is reasonably practicable, the route of the Proposed Development avoids existing features that have the potential to present a hazard to the construction or operation of the Proposed Development. Features external to the Proposed Development that lie within the land required to construct the Proposed Development and/or cross the route of the Proposed Development that present a potential source of hazard, either during construction or operation include, but are not limited to: • oil, gas and electricity transmission; • potential presence of unexploded ordnance; • former landfill sites and the potential presence of landfill gas; • potential presence of coal-bed methane and shale gas; • below ground hazards such as salt and coal mining; • existing operational railway lines; and • adjacent highways, both local roads and motorways.
Sensitive environmental receptors at risk of significant effect	Environmental receptors that may be at risk in the event of a major accident and/or disaster include those close enough to be impacted by a major accident in the Proposed Development construction and operational areas. Relevant receptors for this topic include: • people (including health, wellbeing, property and community); • socio-economics (including agriculture and land use, traffic and transport and essential infrastructure); • environment (including ecology, land quality, air quality, water resources and landscape); and • cultural heritage (including archaeology and built heritage).
Current (without the Proposed Development) major accident and disaster risks	Major accident and disaster risks relevant to the baseline in the absence of the Proposed Development include extreme weather events, associated flooding and road traffic collisions. Baseline 'without project' conditions are discussed in the respective sections of this environmental screening report.

Future environmental baseline

Construction

13.3.2 As set out above, the method for establishing the environmental baseline includes using the baseline components, presented in Table 13.3.1, to consider where adverse effects on the environment may arise as a result of the Proposed Development and identify associated risk events that may result in a major accident or disaster. There is no new future baseline information presented as part of the major accident and disasters assessment.

13.3.3 Committed developments identified in Section 2 of this report would not alter baseline information in respect of major accidents and disasters.

Operation

13.3.4 As set out above, there is no new future baseline information presented as part of the major accident and disasters assessment.

13.4 Effects arising during construction

Avoidance and mitigation measures

13.4.1 The key measures used to mitigate the risk associated with a major accident or disaster during construction are presented in Table 13.4.1 below, which show that the risk will be reduced to a level that is as low as reasonably practicable (ALARP), in line with legal obligations, industry standards and the HS2 Development Agreement[29], as accepted by the Office of Road and Rail (the regulator). The HS2 Development Agreement sets out the requirement to manage all risks to a level that is as low as reasonably practicable. The Proposed Development will be implemented through applying the ALARP principle, such that it is designed and constructed to reduce the risk of harm (including major accidents) occurring to a level that is as low as is reasonably practicable.

Assessment of impacts and effects

13.4.2 Summaries of the major accidents and disasters to which the Proposed Development may be vulnerable during the construction phase and the outcomes of the assessment are summarised in Table 13.4.1. Table 13.4.1 also describes those risk events which could have an impact on environmental receptors (including members of the public who are not employees or passengers) and have the potential to be a major accident as defined in in Table 13.2.1. Taking into account these considerations, there will not be any likely significant environmental effects arising from the vulnerability of the Proposed Development to major accidents and disasters during construction.

[29] Department for Transport and High Speed Two (HS2) Limited, HS2 development agreement, amended 26 November 2018. Available at: https://www.gov.uk/government/publications/hs2-development-agreement

Table 13.4.1 Assessment of major accident and/or disaster events during construction

ID[30]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[31]
C2	Train derailment or collision due to construction activities on or adjacent to existing railway	Network Rail train derailment outside the boundary with potential to cause harm to member of public, property or adjacent land/water course	Working on or near an existing railway is managed in accordance with established industry procedures. CDM will identify specific risks to be managed. Mitigation measures may include speed restrictions in work areas, lifting plans, planned period of closure of railway etc. Consultation with Network Rail is already underway. The CoCP states that emergency procedures for works on the existing railway network should be produced in accordance with established industry procedures.
C3	Road traffic accident due to construction work over or adjacent to existing highways, work on existing structures to move or realign, movement of construction vehicles along public roads and adjacent to public rights of way	Injury or fatality to a member of the public	Risks identified and managed via CDM, construction planning, CoCP, traffic management plan, construction workforce travel plan. Examples of temporary traffic management measures may include speed restrictions and diversions etc. Risk to public road users addressed via consultation on design with Highways England, through design and in construction method statements. Further detail is provided in the 2013 ES, Volume 2 community forum area reports for Traffic and transport (Section 12), as well as Volume 5: Traffic and Transport, as amended.

[30] ID: Risk identification number. Refer to Appendix 14.6.A, Environmental risk record, for detailed table.
[31] As low as reasonably practicable.

ID[30]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[31]
C6	Fire and/or explosion or release of harmful gas, as a result of construction activities. For example: presence of former landfill sites along route; presence of ground gas along route; presence of unexploded ordnance; gas pipeline route; fuel storage at construction sites; wildfire	Fire and/or explosion affects neighbouring property and/or members of the public	Risks identified and managed via CDM (e.g. site searches, ground investigations, consultation with utility providers, construction planning) and via CoCP. Appropriate permanent works design to control long term ground related risks like ground gases. Environmental Management Plans which guide and govern maintenance, and management of risks.
C8	Flood event leads to release of stored construction related material (presence of construction materials, equipment and potential contaminants)	Release of contaminants onto land outside construction site	The CoCP includes measures for contractors to manage risks of pollution due to severe weather events. The CoCP states, as appropriate, that stockpiles and mounds will be kept away from sensitive receptors, watercourses and surface drains where reasonably practicable, and sited to take into account the predominant wind direction relative to sensitive receptors. The CoCP states that reasonable precautions will be taken in relation to the handling and storage of material, including seeding of medium or long-term stockpiles as appropriate.

ID[30]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[31]
C9	Collapse of or damage to existing structures resulting from for example construction activities adjacent to, above/below existing structures	Falling debris or collapse of infrastructure affects a public right of way / public area or leads to injury or fatality of members of public Collapsed culvert leads to flood impact	Construction works adjacent / over public rights of way or to public property are managed via CDM and construction planning. Tunnel design and construction methods includes risk assessment for overlying structures and monitoring or mitigation if required.

Other mitigation and residual effects

13.4.3 No mitigation measures beyond those presented in Table 13.4.1, which summarises the relevant legal obligations, industry standards and obligations under the HS2 Development Agreement, are proposed as part of the assessment. Therefore, effects are as described above.

Cumulative effects

13.4.4 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development.

13.5 Effects arising during operation

Avoidance and mitigation measures

13.5.1 The key measures used to mitigate the risk associated with a major accident or disaster during operation are presented in Table 13.5.1 below, which show that the risk will be reduced to a level that is as low as reasonably practicable, in line with legal obligations, industry standards and the HS2 Development Agreement (26 November 2018), as accepted by the Office of Road and Rail (the regulator). The HS2 Development Agreement sets out the requirement to manage all risks to a level that is as low as reasonably practicable (ALARP). The Proposed Development will be implemented through applying the ALARP principle, such that it is operated and maintained to reduce the risk of harm (including major accidents) occurring to a level that is as low as is reasonably practicable.

Assessment of impacts and effects

13.5.2 Summaries of the major accidents and disasters to which the Proposed Development may be vulnerable during the operation phase and the outcomes of the assessment are summarised in Table 13.5.1. Table 13.5.1 describes those risk events which could have an impact on environmental receptors (including members of the public who are not employees or passengers) and have the potential to be a major accident as defined in in Table 13.2.1. Taking into account these considerations, there will not be any likely significant environmental effects arising from the vulnerability of the Proposed Development to major accidents and disasters.

Table 13.5.1 Assessment of major accident and/or disaster events during operation

ID[32]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[33]
OM1A	Train derailment or collision (HS2 trains). There are multiple potential causes of this event including: electrical infrastructure failure; human factors (drivers, signal control, points etc); infrastructure failure (structure, ground, drainage and/or track); natural hazards such as storm, high wind, freezing temperatures; poor wheel rail interface; rolling stock failure; objects on the line (unauthorised 3rd party access, animals, vehicle incursion, falling trees, debris); system/equipment failure; and vandalism and terrorism (including cyber-attacks).	Off-track and outside boundary derailment causing severe disruption to rail transportation, major accident causing harm to staff, passengers and adjacent receptors. *Note: this section focusses on receptors including members of public and the environment, not staff or passengers.*	In addition to legal obligations and industry standards, specific measures listed below (list is not exhaustive) include those to remove or reduce the likelihood of a train derailing (1) and mitigate the severity (2). **(1)** Training. Operation & Maintenance Manuals. Safe system of working. Interface with classic network must be timely and of high integrity—the interface is defined and all issues should be addressed. Rolling stock design standards. Use of single, unified and modern signalling system, (European Train Control System (ETCS) on HS2 network. Requirement for design to be adequate to protect railway from incursion by objects or vehicles. Provision of a secure boundary. **(2)**

[32] ID: Risk identification number. Refer to Appendix 14.6.1, Environmental risk record, for detailed table.
[33] As low as reasonably practicable.

ID[32]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[33]
			Use of derailment containment measures where reasonably practicable. The railway shall not carry hazardous (combustible/explosive) freight.
OM2	Train derailment or collision (Network Rail trains). As above, there are a number of potential causes of this event related to the interface between the Proposed Development and the existing railway, and shared use of tracks/interface between HS2 network and conventional network.	Off-track and outside boundary derailment of a non HS2 train (including freight), or a HS2 train using conventional track. Severe disruption to rail transportation, major accident causing harm to staff, passengers and adjacent receptors, spillage of pollutants	Must comply with Railway Group Standards to be allowed on the conventional network.
OM3	Major road traffic accident related to presence of new infrastructure (e.g. new junctions, new road alignments, new bridges/underpasses)	Injury or fatality to a member of public. Spillage of pollutants	The traffic and transport sections in the 2013 ES Volume 2, as amended, describe the baseline assessment - accident clusters are identified, and there is no new risk to road traffic compared to baseline assuming bridge and road are designed to standards. Road realignments designed in accordance with standards and in consultation with Highways England and local authorities etc. All new infrastructure designed would be subject to detailed design and safety audit processes to seek to minimise the risk of accidents.
OM4	Collapse or significant movement of structures leading to non-train incident, with multiple potential causes including: bridge strike; vandalism and terrorism; natural hazards (earthquake, scour, high wind); inadequate design; material quality; and lack of maintenance.	Injury or fatality to a member of public (pedestrians, cyclists or road users etc.)	Design to mitigate bridge strike likelihood (clearance, signs, bollards etc.). Structures designed and maintained in accordance with standards in consideration of environmental conditions. Seismic basis of design will be in place for the Proposed Development. Incident response plans for bridge strike.

ID[32]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[33]
OM6	Fire and/or explosion on or near the Proposed Development, due to (e.g.) overheating of tunnels; maintenance activities; wildfire; electrical faults; explosive gases within drainage system. Secondary effect - fire causes degradation to track/infrastructure.	Contamination of aquifer/ drinking water supply resulting from run off of fire water Drift of fire from HS2 facility	Selected measures listed below are a combination of measures to prevent fire occurring through removing or reducing the cause (1); measures to respond and manage an outbreak of fire (2), and measures to mitigate the impact of the response activities (3). **(1)** A tunnel fire risk assessment must be carried out under legislation, to ensure the safety of the occupants of the tunnel and those in the immediate vicinity who are at risk. A fire management strategy for tunnels will be drawn up during detailed design in line with the Technical Specifications for Interoperability[34]. HS2 rolling stock is electric—no flammable fuels. The railway shall not carry hazardous (combustible/explosive) freight. Inspection and maintenance of drainage. **(2)** Assess need for firefighting provision and provide facilities on-site if necessary (emergency procedures). IMB-R design to ensure access for emergency services. **(3)** The fire safety objectives of the project include the protection of the environment.

[34] RSSB (undated), Technical Specifications for Interoperability (TSI). Available at: https://www.rssb.co.uk/standards-and-the-rail-industry/standards-explained/technical-specifications-for-interoperability

ID[32]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[33]
			Any water contaminated by firefighting operations will be discharged into an attenuation pond and discharged safely in agreement with the Environment Agency, local water company and local authority and any other relevant stakeholder.
OM7	The presence of the Proposed Development (e.g. embankments) leads to alteration of flood patterns during an extreme weather (flood) event. Flooding of underpasses or subways.	Flooding impact on property or land, which differs to flooding impact without the presence of the Proposed Development Flooding of underpasses or subways with potential harm to a member of public.	Viaducts, bridges and culverts are designed to accommodate 1 in 100 (1%) annual probability flood. For a flood with an annual probability in excess 1 in 100 years, only minor localised alterations in the distribution of floodwaters relative to the baseline are expected. Critical railway systems and assets are protected to a 1 in 1,000 (0.1%) annual probability flood (i.e. the assets are resilient to this event, but there is no design requirement that the railway should be operational in this event). The drainage infrastructure is designed to ensure that no increases in surface water runoff occurs from the footprint of the Proposed Development. All river, watercourse crossings and drainage infrastructure will be operated and maintained in accordance with the procedures outlined in the 2013 ES, Volume 5: Water resources, as amended.
OM8	Accidental drowning due to presence of balancing ponds and unauthorised 3rd party access.	Member of public accidentally falls into balancing pond and drowns *Note: deliberate trespass including vandalism, terrorism or suicide not in scope of this section, which considers the accidents and their potential impact*	Provision of a secure boundary and other appropriate mitigation measures.

ID[32]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[33]
OM9	Non-motorist falling from bridges, viaducts, cuttings etc., including potential electric shock due to contact with overhead line equipment.	Injury or fatality to a member of public	Design of bridges (including fencing and barriers) will meet regulatory requirements for safety of pedestrians. Crossings must be designed and built to be fit for purpose and compliant with proven industry standards and best practice. Provide appropriate and easy to use crossings. Provision of a secure boundary and other appropriate mitigation measures.
OM10	Vehicle falling from overbridge or adjacent road due to presence of overbridges; access roads adjacent to track; shared HS2 access with public right of way	Injury or fatality to a member of public	Crossings must be designed and built to be fit for purpose and compliant with HS2 standards. Sufficient barrier/protection proportional to the risk. Allowance has been made for vehicle restraint systems (VRS) between track and access roads where roads are adjacent. Only trained rail staff to use access roads. Slow speed access roads.
OM11	Traffic incident involving non-motorists due to e.g. changes to public rights of way, shared HS2 access and accommodation with public right of way. Inappropriate exposure of member of public to IMB-R activities.	Injury or fatality to a member of public	Crossings (over and under) and new road layout must be designed and built to be fit for purpose and compliant with standards. Drivers using road vehicles for maintenance activities - travel time and distance to be limited, training, procedures and licencing to be in place. Design IMB-R to ensure segregation is appropriate.

ID[32]	Risk event	Reasonable worst consequence if event did occur	Key risk management and mitigation measures to demonstrate risks to be ALARP[33]
OM15	Emergency response activities impacts on environmental receptors, due to the existence of incident management plans which focus on the safe evacuation of passengers and staff and have the potential to have an adverse effect on local receptors.	Harm to environmental receptor in the vicinity of an incident *Note: The specific risk related to discharge of firefighting water is presented separately above*	Incident management plans should be developed and communicated sufficiently early enough to influence design. These should include consideration of the local environment and community. Ensure plans are maintained, audited etc. Integrity of communications and processes in event of fire or other incident.
OM16	Electric shock due to exposure to live conductor/arcing etc. related to presence of live conductor and potential for inadvertent contact (both workers and 3rd parties). Overhead line equipment collapse in extreme weather event. Hazard to emergency services using water to fight fire.	Injury or fatality to a member of public	Electrical safety standards, SCADA (supervisory control and data acquisition) standards will be implemented. Isolation and earthing procedures will be undertaken in line with industry standards. Provision of a secure boundary and other appropriate measures.

Other mitigation and residual effects

13.5.3 No mitigation measures beyond those presented in Table 13.5.1, which summarise the relevant legal obligations, industry standards and obligations under the HS2 Development Agreement, are proposed as part of the assessment. Therefore, effects are as described above.

Cumulative effects

13.5.4 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

13.6 Summary

13.6.1 No new or different significant adverse effects would result from the Proposed Development.

13.6.2 Environmental risks in relation to major accidents and disasters would be managed in accordance with legal obligations and industry standards and would not result in significant environmental effects. The requirement to undertake an assessment of the environmental effects of major accidents and disasters has been introduced since the 2013 ES, as amended, and therefore was not included in the 2013 ES, as amended, but has been included as part of this screening report. The approach for this assessment includes consideration of risk events that are relevant to the Proposed Development, identifying whether those risk events constitute a major accident or disaster, defining the impact, and assessing the associated likelihood and risk. In accordance with the HS2 development agreement, the principle of reducing risks to a level that is as low as reasonably practicable (ALARP) would be applied, which is the approach accepted by the Office of Rail and Road. As a result, it is considered that that the Proposed Development would not result in significant environmental effects arising from the vulnerability of the Proposed Development to major accidents and disasters.

14 Socio-economics

14.1 Introduction

14.1.1 This section reports on the environmental baseline, and any likely economic and employment effects during the construction and operation of the Proposed Development. Any new or different likely significant adverse environmental effects as a result of the Proposed Development are identified and compared to those reported in the 2013 ES, as amended.

14.2 Scope, assumptions and limitations

14.2.1 In the 2013 ES, as amended, the socio-economic effects of the Phase One scheme were reported at two different levels: a route-wide level reported in Volume 3 of the 2013 ES, as amended, and a localised level, which reported on businesses and observations on potential local economic effects within each CFA report. The two CFA reports from the 2013 ES, as amended, relevant to this section are CFA 25 (Castle Bromwich and Bromford) and CFA 19 (Coleshill Junction).

14.2.2 The assessment scope, key assumptions and limitations for the screening of potential significant effects on socio-economic reports as a result of the Proposed Development is consistent with the method 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) of the 2013 ES, as amended.

14.2.3 The CFA reports and route-wide assessment were reviewed to determine where significant effects were previously identified for the 2013 ES, as amended. The Proposed Development was compared against the relevant aspects of the Phase One scheme to determine whether there would be new or different significant adverse effects on socio-economic receptors. The baseline information has also been reviewed to include up to date available data (data sources are provided).

14.2.4 The need for a socio-economic assessment results from the potential for the Proposed Development to affect:

- Existing businesses and community organisation and thus the amount of local employment
- Local economies, including employment; and
- Planned growth and development.

14.2.5 The key design changes of the Proposed Development that are relevant to the socio-economic assessment are changes to the temporary and permanent

requirement for land at Castle Bromwich Business Park during construction and the number and location of construction compounds.

14.3 Environmental Baseline

Existing baseline

14.3.1 Section 2 of this report provides a general overview of the area surrounding the Phase One scheme and Proposed Development site, which includes data of specific relevance to socio-economics, notably demographic and employment data. This data has not been updated as it is based on 2011 Census which is the most up-to-date population data available.

14.3.2 The 2013 ES, as amended, presents a baseline that includes an overview of the employment, economic structure, labour market and business premises of the area surrounding the Phase One scheme. The baseline section of this report provides an update to that overview provided in the 2013 ES, as amended, using the latest available data sets.

14.3.3 Data in Section 2 of this report is presented for the demographic character areas (DCA) of Water Orton, Smith's Wood, Castle Bromwich, Castle Vale and Bromford. A DCA represents a community which, depending on the area, may consist of a local ward, neighbourhood or village(s).

14.3.4 The Castle Bromwich DCA and Bromford DCA lie primarily within the area covered by Birmingham City Council (BCC) with the eastern edge of the area being located within the Solihull Metropolitan Borough Council (SMBC) area. The Water Orton DCA area lies within the North Warwickshire Borough Council (NWBC) area. Based on the distribution of affected resources, the focus of the baseline is the area covered by BCC.

Business and labour market

14.3.5 In 2018, approximately 512,000 people worked in the BCC area. According to the Office for National Statistics Business Register and Employment Survey 2018[35], the top four sectors in terms of share of employment were: health (16%), retail (15%), education (11%) and professional, scientific and technical (10%). These compare with three of the top four sectors for the West Midlands region, which were: retail (16.7%), health (14%), manufacturing (12%) and education (9.5%).

[35] Office for National Statistics (2018), Business Register and Employment Survey. Available at: http://www.nomisweb.co.uk. This number includes both residents and non-residents of BCC who work within its boundaries.

14.3.6 According to the Annual Population Survey (2018)[36], the employment rate within the BCC area was 65% (485,900 people), which was less than that recorded for both the West Midlands region (74%) and Great Britain (76%). In the 2013 ES, as amended, the employment rate in the BCC area was reported at 56% (424,00 people) which is less than the 2018 rate. Similarly, the West Midlands region and Great Britain had rates of 62% and 65% respectively which is less than the levels currently reported.

14.3.7 In 2018, unemployment in the BCC area was 9%, which was more than that recorded both for the West Midlands region (4.9%) and Great Britain (3.9%). In the 2013 ES, the unemployment rate in the BCC area was (13%) which was higher than the rate for the West Midlands region (9%) and England (%). This data was obtained from the 2011 Census. Therefore, between 2011 and 2018, the unemployment rate has gone down in the BCC area, the West Midlands Region and in Great Britain.

14.3.8 The Annual Population Survey (2018) also shows that 33% of BCC residents aged 16-64 were qualified to National Vocational Qualification Level 4 (NVQ4) and above, compared to 34% in the West Midlands and 40% in Great Britain, while 12.9% of residents had no qualifications, which was higher than that recorded both for the West Midlands region (10.2%) and Great Britain (7.7%). In the 2013 ES, according to the Census 2011, 23% of BCC area residents aged 16 and over were qualified to NVQ4, compared to 23% in the West Midlands and 27% in England, while 28% of residents had no qualifications which was higher than that recorded both for the West Midlands (27%) and England (23%). Therefore, qualification levels have increased between 2011 to 2018.

Property - Supply of employment land

14.3.9 In the 2013 ES, as amended, the BCC area recorded a supply of employment land in excess of 215ha. Approximately 90ha of this land was considered “readily available”. According to the 2019 BCC Employment Land Availability Assessment, the supply of readily available land has progressively been decreasing in recent years from a high of 138.45ha in 2010-2011 to a low of 41.57ha in 2018-2019.[37]

14.3.10 The current supply of 41.57ha represents 2.16 years of supply which is below the Birmingham Development Plan (2017) policy requirement (Policy TP17)[38] of a five year reservoir of 96ha. Although this is less than half of the policy requirement, this must be considered in the context of the wider regional supply of employment land where there is just 1.6 years of employment land supply.

[36] Office for National Statistics (2018), Annual Population Survey. Available at: http://www.nomisweb.co.uk. This number includes both residents and non-residents of BCC who work within its boundaries.
[37] Based on the Birmingham Development Plan Employment Land Availability Assessment (ELAA) 2019 published by Birmingham City Council.
[38] Birmingham Development Plan 2017, Policy TP17 – Portfolio of employment land and premises.

However, the supply of good quality employment land has been progressively increasing year on year. It is anticipated that this will continue to increase to levels above requirement in the short to medium term.

14.3.11 The supply of not readily available has land fluctuated between 2009 and 2012 but progressively increased from a low of 83.65ha in 2012-2013 to a high of 145.53 ha in 2018- 2019. The larger proportion of the land supply that is not readily available is largely attributable to the allocation of the 71ha site, known as "the Peddimore site" within the Birmingham Development Plan. Planning permission for the Peddimore site was granted in September 2019 and this will help to increase the proportion of readily available land within the overall supply.

Property - Businesses

14.3.12 Castle Bromwich Business Park and Hayward Industrial Estate is located to the north of the M6 and is accessed via Tameside Drive. The Castle Bromwich Business Park is comprised of a mix of manufacturing, logistics and retail businesses. It is located to the south of Castle Vale and is accessible from the A452 and M6.

Future environmental baseline

Construction

14.3.13 No committed developments have been identified that will materially affect the future baseline conditions during construction, for business receptors.

Operation

14.3.14 No committed developments have been identified that will materially affect the future baseline conditions during operation, in 2026 for business receptors.

14.4 Effects arising during construction

Avoidance and mitigation measures

14.4.1 In order to avoid or minimise the environmental impacts during construction, the Phase One scheme includes provisions to maintain access to businesses during the construction phase.

14.4.2 The EMRs include a range of provisions that will help mitigate the socio-economic effects associated with the construction 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;
- reducing nuisance through sensitive layout of construction sites;
- applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors (including local businesses); 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.
- The measures listed above are assumed to be embedded mitigation and have been included within the assessment of the Proposed Development.

Assessment of impacts and effects

Construction - Change in business amenity value

14.4.3 Within the 2013 ES, as amended, no businesses were identified within the area which are expected to experience significant amenity effects as a result of the Phase One scheme. The assessment has not changed as a result of the Proposed Development and no businesses are anticipated to experience significant amenity effects.

Construction - Isolation

14.4.4 Within the 2013 ES, as amended, no businesses were identified to experience significant isolation effects as a result of the Phase One scheme. N. This assessment has not changed as a result of the Proposed Development.

Construction - Employment

14.4.5 There are plans to locate construction compounds for the Proposed Development within the Castle Bromwich and Bromford area. Due to the construction requirements of the Proposed Development, compared to the Phase One scheme, six construction compounds are no longer required. The construction compounds which are no longer required are:

- Bromford tunnel east portal (east) main compound;
- Dunlop carrier channel culvert satellite compound;
- Plants Brook underbridge satellite compound;
- River Tame viaduct satellite compound;
- Castle Bromwich auto-transformer satellite compound; and
- Bromford tunnel east portal building satellite compound.

14.4.6 The construction compounds that are still required are:

- Bromford tunnel east portal main compound (a new compound for the Proposed Development, further details are provided in Section 2 of this report);
- B4118 Water Orton Road overbridge satellite compound (part of Bromford tunnel east portal main compound for the Proposed Development); and,
- Bromford tunnel east portal (west) satellite compound (becomes the Bromford tunnel intermediate shaft satellite compound for the Proposed Development).

14.4.7 The 2013 ES, as amended, reported that the use of the construction sites within the CFA25 area could result in the creation of up to 1344 person years of construction employment[39] opportunities, or approximately 134 full-time equivalent jobs[40] 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 was assessed as part of the route-wide assessment (see Volume 3 of the 2013 ES, as amended). The 2013 ES, as amended, reported that the generation of employment opportunities, at a route wide level, during the construction phase would be a major beneficial effect, which is significant

14.4.8 Although there is a reduced number of construction compounds, the number of construction workers required to undertake the construction work is assumed to be similar to the Phase One scheme. The total number of construction employment opportunities and full-time equivalent jobs are expected to stay the same as originally reported in the 2013 ES, as amended. Therefore, during the construction phase the major beneficial effect, which is significant at a route wide level will remain, as the Proposed Development will be contributing a similar amount of employment opportunities to the area.

14.4.9 The impact of this indirect construction employment creation was previously assessed as part of the route-wide assessment (Volume 3 of the 2013 ES, as amended). A major beneficial effect was reported which was significant. Direct construction employment created by the Proposed Development could also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers.

14.4.10 As the number of direct employment opportunities is predicted to be similar to the Phase One scheme, the impact on indirect construction employment is also considered to be the same. Therefore, the conclusion from the route-wide

[39] 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.
[40] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

assessment on indirect employment opportunities as a result of the Phase One scheme remains and a major beneficial effect, which is significant, is predicted.

Construction - Businesses

14.4.11 The 2013 ES, as amended, reported that 17 business accommodation units within the area will be directly impacted (demolished) by the Phase One scheme due to the requirement of land for construction. These were together defined as one resource because they are located next to one another; the Castle Bromwich Business Park. The 17 businesses located within this part of the Castle Bromwich Business Park are primarily warehousing facilities.

14.4.12 The requirement for land, which necessitated the demolition of industrial and warehousing properties, results in the displacement or possible loss of approximately 220 jobs in the area. The effect on the resources and employees was assessed as a major adverse effect, which is significant. This was due to the need for these businesses to maintain certain time distances from key customers, so finding alternative suitable premises may be challenging.

14.4.13 The Proposed Development also requires land which is adjacent to the existing rail corridor at the north of the Castle Bromwich Business Park. Three plots of land are required temporarily for construction, with two of these plots to be released for commercial use following completion of the construction phase.

14.4.14 However, compared to the Phase One scheme, the temporary and permanent requirement for land at Castle Bromwich Business Park for construction of the Proposed Development is much less, and the land located in the north eastern corner of the Castle Bromwich Business Park is no longer required. Only one business property, the British Auctioneers site, is still required, and this business has already been demolished. As less businesses are required to be demolished as a result of the Proposed Development effects would be reduced compared to the Phase One scheme.

Other mitigation and residual effects

14.4.15 No other mitigation measures are proposed and therefore effects are as described above.

Cumulative effects

14.4.16 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

14.5 Effects arising during operation

Avoidance and mitigation measures

14.5.1 No measures are proposed.

Assessment of impacts and effects

Operation - Change in business amenity value

14.5.2 Within the 2013 ES, as amended, no businesses identified within the area were expected to experience significant amenity effects as a result of the Phase One scheme. This assessment has not changed as a result of the Proposed Development and no businesses are anticipated to experience significant amenity effects.

Operation - Isolation

14.5.3 Within the 2013 ES, as amended, no businesses were identified to experience significant isolation effects as a result of the Phase One scheme. This assessment has not changed as a result of the Proposed Development. No businesses are anticipated to experience isolation effects

Operation - Employment

14.5.4 The 2013 ES reported that direct operational employment created by the Phase One scheme could also lead to indirect employment opportunities for local businesses in terms of supplying the project or benefiting from expenditure of directly employed workers on goods and services. The impact of operational employment creation was assessed as part of the route-wide assessment (see Volume 3 of the 2013 ES, as amended). The assumptions and conclusions in this assessment have not changed as a result of the Proposed Development.

Other mitigation and residual effects

14.5.5 No other mitigation measures are required and therefore effects are as described above.

Cumulative effects

14.5.6 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

14.6 Summary

14.6.1 No new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme.

14.6.2 As in the case of the Phase One scheme, socio-economic effects during construction would be minimised through measures such as applying best practicable means (BPM) to reduce noise and vibration at sensitive locations (including local businesses) and site-specific traffic management measures to limit traffic-related disruption. As less land occupied by businesses would be required for the Proposed Development, compared with the Phase One scheme, socio-economic effects would be reduced. The positive socio-economic effects of the Proposed Development, arising from increased employment opportunities during construction and operation, would be comparable with those arising from the Phase One scheme.

15 Sound, noise and vibration

15.1 Introduction

15.1.1 The environmental baseline relevant to the sound, noise and vibration assessment is described below. Any new or different likely significant adverse environmental effects as a result of the Proposed Development are then identified, compared to those reported in the 2013 ES, as amended.

15.2 Scope, assumptions and limitations

15.2.1 The assessment scope, key assumptions and limitations for the sound, noise and vibration assessment are as 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) of the 2013 ES, as amended. This sound, noise and vibration screening assessment has applied the same methodology. With respect to assessment conclusions, the approach adopted reflects the requirements of the EIA Regulations and Government Noise Policy. Impacts on noise-sensitive receptors are considered in respect of a number of factors associated with construction and operation.

15.2.2 The key design change relevant to the sound, noise and vibration assessment is the extension of Bromford tunnel by over 3km. This removes a number of receptors from exposure to operational airborne noise, replacing it with potential exposure to ground borne noise and vibration; however, these effects are on a small scale in comparison to the effects of the Phase One scheme. In terms of construction works, tunnel boring for the Proposed Development would occur from east to west, rather than west to east (for the Phase One scheme), such that construction activity will be focussed around the east portal rather than the west portal. As such, the corresponding effects have been considered as part of this sound, noise and vibration screening assessment.

15.2.3 The Proposed Development construction noise and vibration study area includes the area around the Bromford tunnel east portal works, and other areas relating to the Proposed Development where the tunnel extension will result in a number of work activities associated with the original design assessed in the 2013 ES, as amended, being removed. At the west end of the tunnel extension, the east portal structure of the Phase One scheme, at the Castle Bromwich Business Park, would be replaced by an intermediate shaft, as part of the Proposed Development, for which the extent of the construction site would be smaller compared to that assessed in the 2013 ES, as amended, and therefore no new significant adverse effects will arise at this location.

15.2.4 The 2013 ES, as amended does not include ground borne noise (GBN) assessments in the ES Baseline documents if the track is surface running (at grade), as in these regions GBN would be expected to be insignificant compared to airborne noise.

15.3 Environmental Baseline

Existing baseline

15.3.1 Relevant baseline information provided within the 2013 ES, as amended by subsequent SESs and AP ESs, is summarised below. Documentation referencing the baseline comprises the following:

- HS2 Phase One (2013) ES, Volume 5, Technical Appendices CFA 19 baseline report: Coleshill Junction (Ref: Appendix SV-002-019, ES 3.5.2.19.10)
- HS2 Phase One (2013) ES, Volume 5, Technical Appendices CFA 19 construction assessment report: Coleshill Junction (Ref: Appendix SV-003-019, ES 3.5.2.19.11)
- HS2 Phase One (2013) ES, Volume 5, Technical Appendices CFA 19 operational assessment report: Coleshill Junction (Ref: Appendix SV-004-019, ES 3.5.2.19.12)
- HS2 Phase One (2013) ES, Volume 5, Technical Appendices CFA 25 baseline report: Castle Bromwich and Bromford (Ref: Appendix SV-002-025, ES 3.5.2.25.10)
- HS2 Phase One (2013) ES, Volume 5, Technical Appendices CFA 25 construction assessment report: Castle Bromwich and Bromford (Ref: Appendix SV-003-025, ES 3.5.2.25.11)
- HS2 Phase One (2013) ES, Volume 5, Technical Appendices CFA 25 operational assessment report: Castle Bromwich and Bromford (Ref: Appendix SV-004-025, ES 3.5.2.25.12)
- HS2 Phase One (2015) Supplementary Environmental Statement and Additional Provision 2 Environmental Statement, Volume 5, Technical Appendices CFA 19: Coleshill Junction (Ref: SES and AP 2 ES 3.5.1.6)
- HS2 Phase One (2015) Supplementary Environmental Statement and Additional Provision 2 Environmental Statement, Volume 5, Technical Appendices CFAs 23-26 (Ref: SES and AP 2 ES 3.5.1.10)

15.3.2 The 2013 ES, as amended, considered construction noise and vibration as well as operational noise and vibration from operational HS2 trains and new or amended roads and railways (where applicable). The noise impacts were assessed in the context of measured baseline noise levels.

15.3.3 The Castle Bromwich and Bromford area spans the M6 corridor, which is one of the most heavily trafficked sections of motorway in Europe and which is elevated for much of its length. Adjacent to the M6 is a busy railway from Birmingham

running east from the city and onward to Derby and the north-east and Leicester and the east. An additional freight-only line from the north merges with the main line just east of Castle Vale. Baseline noise levels are dominated by sound from transportation.

15.3.4 To the north of the M6/rail corridor, the west of the area contains industrial and commercial premises. To the east of the extensive residential area of Castle Vale are more commercial premises and open land. To the south of the M6 and railway corridor lie the largely residential areas of Castle Bromwich and Bromford. The Castle Bromwich Business Park lies north of the M6 and south of the railway where the two diverge south of Castle Vale. Some of the commercial properties on Castle Bromwich Business Park, are significant contributors to the sound environment at residential properties immediately north of the Birmingham and Derby line in Castle Vale. Other main arterial roads in the area are the A452 Chester Road and the A47 Fort Parkway. Daytime sound levels at residential properties close to the M6 and A452 are typically 65 to 70dB reducing to typically around 55dB further into the residential areas.

15.3.5 Further to the east, between the M6 and M42 is the community of Water Orton at which there is also a railway station. As elsewhere in this region, the main contributor to background noise is transportation related.

15.3.6 The reduction in sound level between daytime and night-time sound levels is relatively small (typically less than 5dB) due to the continuous nature of sound from the M6 and other major roads. The area lies approximately 6km to the north-west of Birmingham Airport and under its flight-path. The sound environment is therefore characterised by the sounds of road traffic from the motorway and other major roads, railways, aircraft and industrial and commercial premises. Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in the 2013 ES, as amended (Volume 5: Appendix SV-002-025), and in the community forum area reports listed under paragraph 15.3.1 of this report.

15.3.7 It is likely that the majority of receptors adjacent to the route of the Phase One scheme and the Proposed Development are not currently subject to appreciable vibration, with the exception of those receptors closest to existing railways.

Future environmental baseline

15.3.8 Without the Phase One scheme or the Proposed Development, 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, sound from the interaction between tyres and road surface dominates

and hence the expected growth in traffic is likely to continue to gradually increase ambient sound levels.

15.3.9 A desktop review has been undertaken for new receptors and committed developments within the study area since the 2013 ES, and a number have been identified, including several buildings previously earmarked for demolition as a consequence of the Phase One scheme that may now remain. Among the new residential receptors identified, Twisted Oak Stables (at Water Orton), receptor number 136721, was at the time of the 2013 ES, as amended, assessed as being a commercial receptor only, but is now recognised as both commercial and residential due to a residential static caravan on site.

15.3.10 The future baseline noise levels for construction and operation remains unchanged from that reported in the 2013 ES, as amended. In summary, the assessment of noise from construction activities for the 2013 ES, as amended, assumed a baseline year of 2017 which represented 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 2017 and the future baseline year for construction. The assessment of noise from construction traffic for the 2013 ES, as amended, assumed a baseline year of 2021, representative of the middle of the construction period when the construction traffic flows were expected to be at their peak. As a reasonable worst case, it has been assumed that no change in baseline traffic will occur between 2021 and the future baseline year for construction.

15.3.11 The operational assessment for the 2013 ES, as amended, was based upon the predicted change in sound levels that result from the Phase One 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 2012/13. Where significant effects were identified on this basis, the effects were 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 Phase One Scheme.

15.4 Effects arising during construction

Avoidance and mitigation measures

15.4.1 The assessment assumes the implementation of the principles and management processes set out in the CoCP which are:

- Best Practicable Means (BPM) as defined by the Control of Pollution Act 1974 (CoPA) and Environmental Protection Act 1990 (EPA) will be applied during construction activities to minimise noise (including vibration) at neighbouring residential properties;

- as part of BPM, mitigation measures are applied in the following order:
  - noise and vibration control at source: for example the selection of quiet and low vibration equipment, review of construction methodology to consider quieter methods, location of equipment on site, control of working hours, the provision of acoustic enclosures and the use of less intrusive alarms, such as broadband vehicle reversing warnings; and then
  - screening: for example, local screening of equipment or perimeter hoarding;
- where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the CoCP, noise insulation or ultimately temporary re-housing will be offered as described in Information Paper E23, and implemented as set out in the 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 and vibration, 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 CoCP and appropriate action will be taken by the nominated undertaker as required to ensure compliance.

15.4.2 Specific mitigation in the form of taller noise screening as described in the CoCP has been assumed along edge of the construction site boundary adjacent to the community at; Gilson Road, at the north eastern edge of Gilson, adjacent Gilson Drive, either side of the A446 Lichfield Road, at Water Orton Primary School; Attleboro Lane; to the south of the Proposed Development between the Bromford tunnel east portal works and the commercial/industrial premises and the gypsy and traveller site in Castle Bromwich Business Park; and in the vicinity of the Twisted Oak Riding Stables, off the B4118 Birmingham Road, on the edge of Water Orton.

15.4.3 A slurry treatment plant will now be located adjacent to the new east tunnel portal. This plant will be designed with low noise enclosures around those parts which can be enclosed, and noise barriers will be used to screen open parts such as conveyors and material storage areas.

15.4.4 Noise insulation will be offered for qualifying buildings as set out in the CoCP noise insulation and temporary re-housing section. Noise insulation or ultimately temporary re-housing will avoid residents being significantly affected by levels of construction noise inside their dwellings.

15.4.5 Qualification for noise insulation and temporary re-housing will be identified at least six months (nine months for listed buildings) in advance of works commencing. Qualifying buildings will then be offered noise insulation, 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 avoid significant adverse effects on health and quality of life from construction activities and also when the Proposed Development comes into operation.

Assessment of impacts and effects

15.4.6 This section considers the effects of the Proposed Development. It considers noise and vibration from new plant, haul routes, traffic changes on the road network from construction traffic, and the tunnel boring machine (TBM).) It then compares the findings with the 2013 ES, as amended, in relation to the Phase One scheme, and identifies if any new or different significant adverse effects occur.

15.4.7 These effects are considered in terms of direct effects on individual buildings and on communities and indirect effects, such as the impact of changes in road traffic noise due to construction traffic. In this way, effects may be classified as direct, indirect or community effects as defined by the 2013 ES, as amended.

Construction plant

15.4.8 Tunnel boring machines (TBM) will be used to excavate the Bromford tunnel. Each TBM is likely to generate ground-borne noise and vibration impacts, but only at receptors close to the centre line of the tunnel and only for short periods of time (a few days). Overall, the deeper the tunnel is, the lower the impact. The perceptible noise and vibration will increase as a TBM approaches and diminish as it moves away from the receptor. It is not considered that vibration from TBM will present a risk of building damage.

15.4.9 As the effects of vibration from TBM on building occupants will be short-term they are not considered to be significant. There will be engagement with communities in advance of TBMs passing underneath properties to inform the residents of the tunnelling progress and what to expect whilst the TBM passes.

15.4.10 Assumptions that have been applied in relation to noise and vibration in respect of the Proposed Development include:

- it is expected that most construction activity away from the tunnel portals remains as assessed in the 2013 ES, as amended; and
- that mitigation relating to the proposed slurry treatment plant (STP) and adjacent haul road, concerning Twisted Oak Stables, will be implemented.

15.4.11 The detailed construction programme, methods of construction and construction plant are subject to detailed design. As such, a realistic worst-case scenario has been assessed based on realistic assumptions about plant, on-times consistent with the assumptions made for the 2013 ES, as amended.

Noise effects of the Proposed Development arising from on-site activities

15.4.12 Noise from the following activities has been assessed:

Activity 1 – Site enabling works

A. Site preparation, mobilisation and compound – Tracked excavators, dumper, roller and delivery vehicles to deliver cabins and equipment;

B. Construction of new junction off the B4118 – General earthworks will be undertaken by excavators and dumpers to cut/fill, hand-held breaker will be used to break the hard surface. Chainsaws and a chipper will be used to remove vegetation. Granular fill will be placed. A tarmac paving machine, 1m planer and vibratory roller will be used to lay the blacktop. A circular saw and breaker will be used to provide a cut in the existing carriageway. Lorry with lifting boom and hand-held tools will be used for installation works. Delivery vehicles will be expected for material delivery; and

C. Construction of haul road to Bromford tunnel – Excavators and dumpers will be used to re-shape the site and transported the site material and stockpiled. Rollers, excavators, dumpers will be used for earthworks. Diesel pumps will be used during construction. Delivery vehicles will be expected for material delivery.

Activity 2 – Tunnel construction

A. Construction traffic noise from the haul road – material delivery such as engineering fill, granular material, ready-mix concrete, reinforcement steel; and

B. Slurry treatment plant (STP) – 2 STPs will be operational 24/7, the purpose of the STP is for the tunnel spoil to be treated before disposal.

15.4.13 In order to avoid significant adverse noise effects from on-site activities, a combination of mitigation to the STPs, noise barriers strategically placed around plant and the haul route, temporary re-housing of receptor 136721 Twisted Oaks

Stables (commercial and residential), and potential noise insulation to receptors 136661 Hill Crescent and 137618, 4 Avis Walk will be required., With all these measures in place, no significant adverse noise effects from on-site activities are predicted.

Noise effects of the Proposed Development arising from construction traffic

15.4.14 The change in road traffic noise due to the addition of construction road traffic for the Proposed Development has been reviewed. Based on the traffic information, the changes of the traffic are as follows:

- Bromford tunnel east portal area: all new traffic movements associated with the East Portal works will access the site initially via the B4118 Birmingham Road. After approximately one year the main access for heavy goods vehicles will be the new haul route (M6-M42 link), while the B4118 Birmingham Road access will continue to be used for construction worker vehicles. In respect of sound, noise and vibration, it is predicted that there would be no notable increase in traffic on local roads or the motorway network; and
- Castle Bromwich Area: The six compounds previously required would be replaced by the Bromford tunnel intermediate shaft satellite compound for the Proposed Development. Construction traffic to the local roads is predicted to be reduced, and the construction traffic movement in this area is predicted to be no worse than the original design.

15.4.15 No significant adverse noise effects from construction traffic are therefore identified.

Vibration effects arising from the Proposed Development, during construction

15.4.16 Construction vibration effects may occur due to the additional tunnel boring activities along the extended underground scheme alignment, and vibration from the relocated STP plant within the Bromford tunnel east portal main compound.

15.4.17 No significant adverse effects are predicted for the STP. A high level assessment was undertaken for vibration due to the TBM activity and this assessment confirms the outcome of the 2013 ES, as amended, that noted it would not have any significant effects. Any issues would be managed by stakeholder engagement and temporary relocations as the effects of the TBM are transient and over a relatively short timescale.

Construction effects summary

15.4.18 Table 15.4.1 below summarises the effects that were identified in the 2013 ES, as amended, for the study area within community forum areas 19 and 25 for the Phase One scheme, and for the Proposed Development. Noise and vibration construction effects are classified as direct, indirect and on a community basis for residential receptors and as direct and indirect for non-residential receptors.

Table 15.4.1 Summary of construction effects of the Phase One scheme and of the Proposed Development

Source	Receptor Type	Direct Impact	Indirect Impact	Communities Impact
Phase One scheme: Construction noise and vibration	Residential	24 dwellings exceed noise insulation threshold. With mitigation no significant effects	Significant effects at approximately 10 dwellings[41]	Significant effects at approximately 20 dwellings[42] Significant adverse effects at 55 dwellings identified on a community basis, resulting from either construction noise or construction noise and vibration in combination[43]
	Non residential	Significant effects at 5 commercial properties at Highway Point and Bromwich Court on the western edge of the Coleshill Industrial Estate[44]. Further significant effect identified at Tree House School, but with mitigation, not significant. Significant effects at 9 commercial premises[45]	No significant effects	Not applicable

[41] CSV19-C03: Approximately 10 dwellings in Gilson Drive closest to the Proposed Development. Forecast increases in in outdoor noise levels of 6.5 dB during the peak months.
[42] CSV19-C01: Approximately 7 dwelling on Attleboro Lane are affected during the day for a duration of 12 months. CSV19-C02: Approximately 13 dwellings on Gilson Road and Meadowbank Drive are affected during the day for a duration of 10 months and 7 months for construction noise and ground-borne vibration respectively
[43] CSV25-C01: Approximately 25 dwellings on Blenheim Way and Cadbury Drive are affected at night for a duration of 1 month, of which approximately 15 dwellings on Blenheim Way are also affected during the day for a duration of 8 months; CSV25-C02: Approximately 30 dwellings on Wanderer Walk and Chillinghome Road during the day for a duration of 1-2months; Some of the closest dwellings at Spitfire Way, Blenheim Way and Javelin Avenue, the impact during are 1 month and have 1 dB exceedances, the significant effect is not considered.
[44] CSV19-N01: Commercial properties located on the western edge of the Coleshill Industrial Estate are affected. Bromwich Court is affected during the day for a duration of 16 months.
[45] CSV25-N01: 4 premises in the Castle Bromwich Business Park to the east portal due to daytime construction noise for a duration of 10 months; CSV25-N02: 1 care home on Cadbury Drive due to daytime construction noise for a duration of 7 months; CSV25-N03: 1 premise on Cadbury Drive due to daytime construction noise for a duration of 7 months.; 8 CSV25-N04: 3 premises on Tame Valley Academy, Bromford due to daytime construction noise for a duration of 2 months.

Source	Receptor Type	Direct Impact	Indirect Impact	Communities Impact
Proposed Development: Construction noise and vibration	Residential	No significant effects, as per Phase One Scheme	Significant effects likely to remain[46]	Significant effects likely to remain[47]
	Non residential	No significant effects, as per Phase One Scheme	No significant effects, as per Phase One Scheme	Not applicable

Other mitigation and residual effects

15.4.19 No other mitigation is required, and the effects of the Proposed Development are as described above.

Cumulative effects

15.4.20 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

15.5 Effects arising during operation

Avoidance and mitigation measures

15.5.1 The Proposed Development has, as far as reasonably practicable, kept the alignment away from main communities and low in the ground. These avoidance measures have protected communities from likely significant noise or vibration effects.

Airborne noise

15.5.2 HS2 trains will be quieter than the relevant current European Union specifications. Train mitigation 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.

15.5.3 To avoid or reduce significant airborne noise effects, the Phase One scheme incorporates noise barriers in the form of landscape earthworks, noise fence barriers and barriers and parapets on viaducts.

[46] No change expected to significant impact CSV19-C03 for approximately 10 dwellings in Gilson Drive closest to the Proposed Development.
[47] No change expected to significant impact CSV19-C01: approximately 7 dwellings on Attleboro Lane, Water Orton and CSV19-C02 approximately 13 dwellings on Gilson Road and Meadowbank Drive, closest to the Proposed Development. No change expected to significant impact CSV25-C01 for approximately 25 dwellings on Blenheim Way and Cadbury Drive and CSV25-C02 for approximately 30 dwellings on Wanderer Walk and Chillinghome Road.

15.5.4 Tunnel portals will be designed to avoid any significant airborne noise effects caused by the trains entering the tunnel.

15.5.5 Significant noise effects from the operational static sources such as line-side equipment will be avoided through their design and the specification of noise emission requirements.

15.5.6 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations and as set out in HS2 Information Paper E20: Control of Airborne Noise from Altered Roads and the Operational Railway.

Ground-borne noise and vibration

15.5.7 Significant ground-borne noise or vibration effects will be avoided or reduced as far as reasonably practicable through the design of the track and track-bed.

Assessment of impacts and effects

15.5.8 This section considers the findings of the 2013 ES, as amended, and then considers the effects of the Proposed Development. It considers operational airborne noise and operational ground-borne noise and vibration.

15.5.9 These effects are considered in terms of direct effects on individual buildings and on communities and indirect effects such as the impact of changes in road traffic noise. In this way, effects may be classified as direct, indirect or community effects as defined by the 2013 ES, as amended.

15.5.10 There are a number of assumptions that have been applied in relation to the consideration of noise and vibration in respect of the Proposed Development. It is expected that train source noise levels are no higher than the 2013 ES, as amended and, in particular, that speeds are expected to remain the same as set out in the 2013 ES, as amended.

15.5.11 The study area identified in the 2013 ES, as amended, for operational noise and vibration remains unchanged in terms of distance from horizontal alignment of the proposed HS2 railway. The extension of the tunnel and alterations to vertical alignment, as part of the Proposed Development, will generally reduce overall exposure operational airborne noise, ground-borne noise and ground-borne vibration at receptors in the vicinity.

Airborne noise effects arising from the Proposed Development, during operation

15.5.12 When compared with the 2013 ES, as amended, for the Phase One scheme, the Proposed Development will remove a number of receptors (those that were

previously within the area of the proposed extension i.e. the new tunnel until it is at grade) from exposure to airborne noise from HS2 trains where the alignment goes into the new tunnel, and those receptors close to the new tunnel portal location will experience no greater effects from airborne noise than predicted in the ES, which reported no significant effects from airborne noise.

Ground-borne noise and vibration (GBNV) effects arising from the Proposed Development, during operation

15.5.13 Receptors near the Bromford tunnel east portal have the potential to be impacted by ground borne noise where previously airborne noise would have had a greater influence. An assessment has been undertaken at new and existing receptor locations. The GBNV assessment is based on the appropriate running speeds of the train at this location and train frequency information.

15.5.14 The assessment indicates that that effects from operational ground borne noise and vibration will be negligible and are therefore not significant. It is not anticipated that any further steps are required in mitigating the levels of GBNV for operation of the railway for any of the noted receptor locations.

Operational effects summary

15.5.15 Table 15.5.1 below summarises the effects that were identified in the 2013 ES, as amended, for the study area within CFAs 19 and 25 for the Phase One scheme and for the Proposed Development. Airborne and ground-borne operational noise and vibration operational effects are classified as direct, indirect and on a community basis for residential receptors and as direct and indirect for non-residential receptors.

Table 15.5.1 Summary of operational effects of the Phase One scheme and the Proposed Development

Source	Receptor Type	Direct Impact	Indirect Impact	Communities Impact
Phase One scheme: Operational noise and vibration	Residential	No significant effects with mitigation	No significant effects	Significant effects at approximately 10 dwellings[48] from airborne noise and vibration only

[48] OSV19-C01: Approximately 10 dwellings in the vicinity of Meadowbank Drive and B4117 Gilson Road, closest to the Proposed Development. Forecast increases in sound from the railway are likely to cause a minor airborne noise adverse effect. A minor ground-borne vibration adverse effect is also forecast at the very closest buildings.

Source	Receptor Type	Direct Impact	Indirect Impact	Communities Impact
(including ground-borne noise and vibration)	Non residential	Significant effects from airborne noise only at identified at Bromwich Court, Highway Point[49]	No significant effects	Not applicable
Proposed Development: Operational noise and vibration (including ground-borne noise and vibration)	Residential	No significant effects, as per Phase One Scheme.	No significant effects, as per Phase One Scheme.	Significant effects likely to remain[50] from airborne noise and vibration only
	Non residential	Significant effects likely to remain[51] from airborne noise only	No significant effects, as per Phase One Scheme.	Not applicable

15.5.16 A new electrical substation is proposed adjacent to the scheme on Attleboro Lane. No adverse effects of the substation are predicted in conjunction with the Proposed Development.

Other mitigation and residual effects

15.5.17 No other mitigation is required, and the effects of the Proposed Development are as described above.

Cumulative effects

15.5.18 No cumulative effects have been identified as a result of the Proposed Development, the near-by WPD substation, and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

15.6 Summary

15.6.1 No new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme.

15.6.2 The area around the Proposed Development is already affected by noise sources including the M6 and M42 motorways, overflying aircraft and other highways and main line railways. Noise receptors in the area include dwellings, industrial and commercial buildings. Additional sources of noise and vibration, as a result

[49] OSV19-N01: Office developments at Bromwich Court and Highway Point, noise disturbance during office activities inside buildings due to the operation of train services.
[50] No change expected to significant impact OSV19-C01 for approximately 10 dwellings in the vicinity of Meadowbank Drive and B4117 Gilson Road, closest to the Proposed Development.
[51] No change expected to significant impact OSV19-N01: Office developments at Bromwich Court and Highway Point.

of the Phase One scheme and Proposed Development, include temporary sources during construction and permanent sources during operation of the railway. These may be further subdivided into direct effects from the noise and vibration sources themselves, such as the tunnel boring machine during construction and from trains on the operational railway, and indirect effects such as noise changes due to road traffic diversions. The 2013 ES, as amended, considered all of these additional sources of noise and vibration and in some cases significant adverse effects were expected to arise. Some different construction activities would occur as a result of the Proposed Development, as compared with the Phase One scheme, but none of these are expected to produce new or different significant adverse sound, noise and vibration effects. The Proposed Development would reduce operational airborne noise for a number of receptors, as compared with the Phase One scheme, due to the placing of exposed track in tunnel, in the vicinity of those receptors. Levels of operational ground-borne noise and vibration would not materially change as a result of the Proposed Development, compared with the Phase One scheme.

16 Traffic and transport

16.1 Introduction

16.1.1 The environmental baseline relevant to the traffic and transport assessment is described below. Any new or different likely significant adverse environmental effects as a result of the Proposed Development are then identified, compared to those as a result of the Phase One scheme.

16.2 Scope assumptions and limitations

16.2.1 The assessment scope, key assumptions and limitations for the traffic and transport assessment are as 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 Part 1 of the Transport Assessment (Volume 5, Appendix: TR-001-000) of the 2013 ES, as amended. This traffic and transport screening assessment has been based on the same assessment approach, with the level of assessment undertaken being proportionate to the screening exercise.

16.2.2 With respect to assessment conclusions, the minor, moderate and major effect significance categories are considered to comprise significant effects for the purposes of the EIA Regulations.

16.2.3 Information used to inform this assessment has been obtained from the 2013 ES, as amended, Community Forum Area (CFA) reports for Coleshill Junction (CFA19), Cudworth to Middleton (CFA20) and the Castle Bromwich and Bromford area (CFA25). Information has also be obtained from the 2013 ES, as amended, Transport Assessment (TA) Technical Appendices (CFA19, CFA20, CFA25, and Annex D Traffic data used for Air Quality, Volume 5).

16.2.4 The spatial scope for the screening of traffic and transport effects covers the area that will be subject to physical changes associated with the Proposed Development, together with the area over which the Proposed Development is expected to have an influence. This therefore comprises the alignment of the tunnel extension plus associated works, along with areas of the highway network that are likely to experience a change in traffic associated with the Proposed Development.

16.2.5 The 2013 ES, as amended, provides details of the trip generation associated with each construction compound, comprising construction related goods vehicles and workforce vehicle trips. Construction traffic routes associated with the affected compounds are based on the descriptions and supporting Volume 5 Map Book provided within the 2013 ES, as amended. Construction HGV traffic

will be required to follow agreed routes and all construction HGV traffic is assumed to follow those routes proposed to/from the main access for each compound as detailed in the 2013 ES, as amended.

16.2.6 Construction traffic routes provided within the 2013 ES, as amended detail the route between each construction compound and the strategic motorway network. This screening exercise has therefore considered the likely change in construction traffic on the local highway network between each affected construction compound and the motorway but has not considered trips once on the motorway network. This is because changes on the motorway network as a result of the Proposed Development reflect a very small change to the overall total traffic. There is one exception, namely the M6 between junctions 5 and 4a which has been calculated in support of the air quality screening assessment (Section 5).

16.2.7 Vehicle trips generated by construction HGV traffic have been manually assigned to proposed lorry routes linking construction compounds to the strategic road network. Where a lorry route serves a single construction compound, the trip generation of the construction activity for the compound served has been assigned to that route. Where a lorry route serves more than one construction compound, the flows from the different compounds have been combined and assigned to that route. Where there is not one specific destination and the proposed lorry routes divide, providing a choice of routes, the vehicle trip generation has generally been split equally between the route choices available.

16.2.8 Traffic forecasts within the 2013 ES, as amended, assumed that 15% of the daily deliveries of construction material and equipment occur during the morning peak hour (08:00-09:00) and 5% during the evening peak hour (17:00-18:00). Similarly, it was assumed that 5% of excavated material removal takes place within the morning peak hour and 20% within the evening peak hour. This screening assessment has adopted a simplified worst-case assumption that 25% of all heavy goods vehicle movements would take place within both the morning and evening peak hour.

16.2.9 For each construction compound the distribution of workforce trips have been calculated by considering the likely catchment areas for construction workers, along with assumptions for modals splits and vehicle occupancies for cars/LGVs to and from each compound. Assumptions regarding the proportion of workforce trips being undertaken throughout the day have been based on assumptions adopted within the 2013 ES, as amended. This assumed that 50% of workforce trips would take place between 08:00-09:00 and 17:00-18:00 at sites operating core hours (08:00-18:00). However, the majority of the construction workforce is likely to commute to work before 08:00 in the morning, in advance of the morning peak 'rush hour' on the road network and

consequently the assessments reflect a reasonable 'maximum most likely scenario'. Compounds associated with tunnelling works (such as the Bromford tunnel east portal main compound) will be operational 24 hours a day. At the Bromford tunnel east portal main compound it is assumed that office workers would travel at the same times as core hour compounds, meanwhile non-office workers would be assumed to have shift changeover times that do not coincide with the highway peak hours.

16.2.10 The 2013 ES, as amended, provides details of each compound start-up date, duration of use, duration of busy vehicle movements and average daily combined two-way vehicle trips during the busy period and the peak month of activity. The busy period represents the period when the construction traffic flows will be greater than 50% of the peak month flows. However, the dates of the busy period and peak months are not provided. The CFA 25 Volume 2 report in the 2013 ES, as amended, also notes that "the assessment scenario has assumed the peak month for the combination of activities, i.e. not necessarily the peak activity at each individual site".

16.2.11 The forecast change in traffic associated with incorporation of the Proposed Development therefore comprises a likely range of change, with the absolute maximum change corresponding to the peak month change (which assumes that all construction compounds were scheduled to operate at peak activity during the assessment scenario) and a lower level of change corresponding to the busy period change (which assumes that all construction compounds were scheduled to operate during the busy period for the assessment scenario). It is, however, possible that the change in traffic could be lower than this range, as some compounds may be scheduled to operate in a non-busy period during the assessment scenario. These forecast changes in busy period and peak month traffic flows have been used to inform the screening assessment for this traffic and transport section, along with the air quality (Section 5) and sound, noise and vibration (Section 15) assessments.

16.2.12 The Bromford tunnel east portal main compound would provide two vehicular accesses; from the B4118 Birmingham Road and from the M6-M42 link road. The main access and egress for heavy goods vehicles associated with the tunnel works would be taken from the eastbound hard shoulder of the M6-M42 link road. This access would be restricted to construction related large goods vehicles / heavy goods vehicles only. It is estimated that these works would generate up to 420 combined two-way lorry vehicle trips per day, comprising approximately 120 two-way trips associated with the tunnelling works and 300 two-way trips associated with other HS2 Phase One vehicles from the east. It has been assumed that the reduction in daily trips at the western portal, due to the transfer of tunnelling activities, would be equal to the 120 daily trips estimated at the eastern portal. It has also been assumed that the total combined 420 trips

would occur in both the peak month and busy period. Worker vehicles (i.e. cars and light goods vehicles) associated with the tunnel works and other HS2 Phase One vehicles from the east would access the site via the B4118 Birmingham Road access.

16.2.13 The Bromford tunnel east portal (west) satellite compound, as reported in the 2013 ES, as amended, would be retained as part of the Proposed Development and will hereafter be referred to as the Bromford intermediate shaft satellite compound.

16.2.14 The western portal compounds include three separate accesses to the highway network, however the split of construction vehicle activity by access is not provided within the 2013 ES, as amended. As a result, the reduction in trips associated with the western portal have been assessed from the point where trip routings from all three junctions would be present on the highway network, which is from the A47 Fort Parkway for trips via M6 Junction 5 and the A4040 Bromford Lane for trips via the M6 Junction 6. There are therefore potential further reductions in traffic associated with the Proposed Development on the A47 Heartlands Parkway and the A4040 Bromford Lane south of the A47 junction. However, owing to uncertainty on the distribution of those reductions, a worst-case scenario has been assumed whereby traffic movements are assumed to remain unchanged from the volumes reported in the 2013 ES, as amended. These sections of road are therefore screened out of further consideration.

16.2.15 Forecast changes in traffic have been calculated external to a strategic traffic model. As a result, any potential redistribution impacts will not be accounted for. These changes are only possible to forecast using a specialist transport model. However, the effect of this potential redistribution is likely to be limited and not expected to affect the assessment.

16.2.16 No detailed junction modelling has been undertaken for this screening assessment. However, all junction models reported in the 2013 ES, as amended, within the study area of this assessment have been reviewed and quantitatively assessed to calculate an estimated junction performance with the Proposed Development based on the baseline and with Phase One scheme junction model results. This method of assessment likely over-estimates the impact of the Proposed Development at signalised junctions, as potential optimisations in signal timings are not allowed for, but likely under-estimates the impact at priority junctions, where changes in opposing traffic may not be accurately reflected in the results. In all cases professional judgement has been applied to determine whether there is likely be a significant effect as a result of the Proposed Development.

16.2.17 The screening assessment has applied a precautionary approach, whereby caution is exercised in order that professional judgement is inclined towards concluding a reasonable worst-case outcome in the event of uncertainty regarding selection from more than one possible outcome.

16.2.18 The limitations and assumptions detailed above are not considered to affect the robustness of this screening exercise.

16.3 Environmental Baseline

Existing baseline

16.3.1 The existing baseline remains as described in the 2013 ES, as amended, except for new daily traffic data that has been collated and calculated along sections of the B4117, B4118 and Newport Road, which are reported in Section 16.4 and Appendix 16.1 of this screening assessment.

16.3.2 Baseline information provided within the 2013 ES, as amended, relevant to the study area of the Proposed Development is provided below.

16.3.3 Existing baseline conditions were determined through site visits, specially commissioned traffic surveys and liaison with transport authorities and stakeholders to source transport data, information on public transport, public rights of way (PRoW) and accident data.

16.3.4 Traffic surveys were undertaken on all roads crossing the Phase One scheme route or potentially affected, comprising junction turning counts, queue length surveys, automatic traffic counts and parking accumulation surveys. This was supplemented by traffic and transport data obtained from other sources where available, including from Birmingham City Council (BCC), Solihull Metropolitan Borough Council (SMBC), Centro and Highways England. The highway peak hours in the study area were 08:00-09:00 and 17:00-18:00 hours.

16.3.5 Surveys of pedestrian and cyclist movements were undertaken 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 Phase One scheme, and any additional PRoW and roads that will be affected by the Phase One scheme. There are no PRoWs affected by the Phase One Scheme or the Proposed Development within the study area of this screening assessment. However, the alignment will cross the footway on the B4118 Birmingham Road/Water Orton Road, near to the existing bridge over the M6 and A452, and the A452 Chester Road, north of the M6 Junction 5.

16.3.6 There are several strategic routes that pass through the area. The M6 follows a broadly south-east/north-west route within this area; it is accessed via the A446

Stonebridge Road at Junction 4 and the A452 at Junction 5. The M42 crosses the M6 by Chelmsley Wood and then travels broadly parallel to the M6 through the area past Coleshill; it is accessed via the A45 at Junction 6 to the south and the A446 and A4097 at Junction 9 to the north. The M6 Toll diverges north from the M6 at Junction 3a and forms an extended junction with the M42 through this area, diverging just south of M42 Junction 9. There are connections between the M6 and M42 at Junction 4 (M42 Junction 7/7a) and 4a (M42 Junction 8).

16.3.7 The main local roads likely to be affected by changes in traffic associated with the Proposed Development comprise, from west to east, the A38 Tyburn Road / Kingsbury Road, the A47 Fort Parkway, the A4040 Bromford Lane / Wheelright Road, the A452 Chester Road and to the east of the M6 Junction 5, the B4114 Bradford Road, the B4118 Water Orton Road / Birmingham Road / Marsh Lane, the B4117 New Road / Watton Lane, and the A446 between the A4091 and M6 Junction 4.

16.3.8 Relevant accident data for the road network subject to assessment was obtained from local authorities, for a three-year period up to 2012. Analysis of data over a three-year period identified that the following two junctions within the study area experienced a large concentration of accidents:

- A446 Lichfield Road / Faraday Avenue junction with ten accidents over the three-year period; and
- M42 Junction 9 roundabout with the A446 Lichfield Road and A4097 Kingsbury Road with 14 accidents over the three-year period.

16.3.9 There are a number of public bus services that pass through the area, providing connections to most local destinations in the area, including Birmingham city centre, Solihull, Water Orton and Coleshill.

16.3.10 The Phase One scheme and Proposed Development do not cross any rail lines within the study area. The nearest railway station is located in the village of Water Orton, which is served by regular CrossCountry services operating on the Birmingham-Derby Line.

16.3.11 A number of formal cycle routes pass through the area and there are also a number of advisory cycle routes.

16.3.12 The nearest navigable waterway to the Phase One scheme in this area is the Birmingham and Fazeley Canal, which is located approximately 750m north of the Phase One scheme Bromford tunnel east portal.

Future environmental baseline

16.3.13 The future baseline is described in the 2013 ES, as amended. There is no change to the future baseline as reported in the 2013 ES, as amended.

16.3.14 The 2013 ES, as amended, details how future baseline traffic volumes were derived. Future baseline traffic volumes for the assessment years of 2021, 2026 and 2041 were calculated by applying growth factors derived from TEMPRO[52] and taking account of any major locally consented schemes. The Castle Bromwich Business Park is affected by the Bromford tunnel east portal, which would result in displaced businesses. The traffic associated with these businesses was not deducted from the future year traffic flows, and as a consequence adverse traffic effects may be over-stated.

16.3.15 Construction activities were assessed against 2021 baseline traffic flows, irrespective of when they occur during the construction period.

16.4 Effects arising during construction

Avoidance and mitigation measures

16.4.1 A summary of key avoidance and mitigation measures identified in the 2013 ES, as amended, of relevance to this assessment include:

- Transportation of materials and equipment along haul routes, where reasonably practical, to reduce lorry movements on the public highway.
- Construction traffic routing, as far as reasonably practicable, along the strategic road network and using designated routes for access, to reduce lorry movements on the public highway.
- Provision of on-site welfare facilities to reduce daily travel by site works.
- Implementation of measures contained within the CoCP, including controls on vehicle types, hours of site operation, staff changeover times and HGV routes, that reduce the impact of construction traffic on the highway network, particularly during highway peak hours.
- Implementation of measures contained within the Workforce Travel Plan to reduce the number of trips associated with workforce travel.

16.4.2 In addition to the mitigation measures identified in the 2013 ES, as amended, additional traffic management mitigation measures would be implemented as part of the Proposed Development at the B4118 access to Bromford tunnel east portal main compound, owing to congestion within the village of Water Orton during the evening rush hour. HS2 Ltd have committed to implementing and enforcing measures that would direct all traffic leaving the compound during the PM Peak period (17:00-18:00) to turn out of the compound and travel

[52] TEMPRO – The Department for Transport's Trip End Model Presentation Program

westbound away from the village of Water Orton, towards the M6 Junction 5. No traffic exiting the compound would be permitted to turn out of the compound and travel eastbound towards Water Orton during this period.

Assessment of impacts and effects

16.4.3 The following paragraphs provide a summary of the methodology applied to determine the likely change in traffic levels resulting from incorporation of the Proposed Development, as compared to the Phase One scheme.

16.4.4 The Proposed Development would result in five construction compounds that were needed for the Phase One Scheme no longer being required. As a result, the trips associated with these five compounds would no longer be present on the highway network. These compounds comprise:

- Bromford tunnel east portal (east) main compound;
- Dunlop carrier channel culvert satellite compound;
- Plants Brook underbridge satellite compound;
- River Tame viaduct satellite compound; and
- B4118 Water Orton Road overbridge satellite compound.

16.4.5 In addition to the reduction in traffic associated with the removal of the above construction compounds, tunnel operations would now be driven from the east portal instead of the west portal. Highway trips associated with the tunnelling works include segment deliveries and transportation of excavated material. These activities are planned to take place at the following three west portal compounds within the Phase One scheme:

- Bromford tunnel west portal (west) satellite Compound
- Bromford tunnel west portal (central) satellite Compound
- Bromford tunnel west portal (east) main Compound

16.4.6 Owing to the transfer of tunnelling works to the eastern portal, construction trips to and from the Bromford tunnel west portal compounds would be expected to reduce.

16.4.7 The Bromford tunnel east portal (west) satellite compound would be retained as part of the Proposed Development and is hereafter referred to as the Bromford intermediate shaft satellite compound.

16.4.8 A summary of the construction lorry routes associated with the above affected Phase One Scheme construction compounds are set out below:

- Bromford tunnel east portal (east) main compound: Tameside Drive / A452 Chester Road / M6 (Junction 5);

- Dunlop carrier channel culvert satellite compound: Maintenance access roads at M6 Junction 5 on-slip / A452 / M6 (Junction 5 or Junction 6 via the A38 Tyburn Road);
- Plants Brook underbridge satellite compound: B4118 Birmingham Road / B4114 Bradford Road / Newport Road / M6 (Junction 5 or Junction 6 via the A38 Tyburn Road);
- River Tame viaduct satellite compound: B4118 Birmingham Road / B4114 Bradford Road / Newport Road / M6 (Junction 5 or Junction 6 via the A38 Tyburn Road);
- B4118 Water Orton Road overbridge satellite compound: M42 Junction 9 / A446 / B4117 / B4118;
- Bromford tunnel west portal compounds (west, central and east): A47 / A452 / M6 Junction 5, or A440 / A38 / M6 Junction 6; and
- Bromford intermediate shaft satellite compound: Tameside Drive / A452 Chester Road / M6 (Junction 5 or Junction 6 via the A38 Tyburn Road).

16.4.9 There would be a new Bromford tunnel east portal main compound which would be in a similar location to the B4118 Water Orton Road overbridge satellite compound within the Phase One scheme. During the initial civil engineering works all construction traffic would access the compound from the B4118 Birmingham Road for a period of approximately one year.

16.4.10 After approximately one year the main access and egress for heavy goods vehicles would be taken from the eastbound hard shoulder of the M6-M42 link road. This access would be restricted to construction related heavy goods vehicles only and would be used for the delivery of tunnel segments and the removal of material away from the Proposed Development. The B4118 Birmingham Road access would continue to be used as the access and egress for construction worker vehicles (cars and LGVs).

16.4.11 The construction lorry route for heavy goods vehicles accessing the Bromford tunnel east portal main compound B4118 access would be a one-way route from the M42 Junction 9, along the A446 Lichfield Road, B4117 Watton Lane, B4118 Birmingham Road and into the compound. Vehicles leaving the site would then continue to travel westbound along the B4118 Birmingham Road / Water Orton Road, B4114 Bradford Road, Newport Road and the M6 (Junction 5 or Junction 6 via the A38 Tyburn Road).

16.4.12 Once the Bromford tunnel east portal main compound M6-M42 link road access is operational, tunnel works at the eastern portal and the assets south of Water Orton would be estimated to generate up to 420 combined two-way lorry vehicle trips per day. The M6-M42 link road access would be constructed and operated within traffic management layout under consent from Highways England. Access

and egress would be taken from the eastbound hard shoulder of the M6-M42 Link Road.

16.4.13 Table 16.4.1 provides a summary of the forecast trip generations of the proposed and affected construction site compounds as reported in the 2013 ES, as amended.

Table 16.4.1 Forecast construction site compound vehicle trip generation

Compound Name	**Average daily combined two-way vehicle trips during busy period and within peak month of activity**			
	Phase One Scheme		Proposed Development	
	Cars & LGV	HGV	Cars & LGV	HGV
Bromford intermediate shaft satellite compound (previously the Bromford tunnel east portal (west) satellite compound)	30-60	130-200	40	60
Bromford tunnel east portal (east) main compound	15-20	103-110	0	0
Dunlop carrier channel culvert satellite compound	20	89-90	0	0
Plants Brook underbridge satellite compound	20	39-40	0	0
River Tame viaduct satellite compound	45-60	20	0	0
B4118 Water Orton Road overbridge satellite compound	45-65	20-35	0	0
Bromford tunnel west portal (east, central and west) compounds	384-480	540-782	384-480	420-662
Bromford tunnel east portal main compound B4118 Access (Before M6-M42 Motorway Link Access Opens)	0	0	758-832	80
Bromford tunnel east portal main compound B4118 Access (After M6-M42 Motorway Link Access Opens)	0	0	758-832	48-72
Bromford tunnel east portal main compound (M6-M42 Link Access)	0	0	0	420

Note: Two-way trips refer to the total number of vehicle movements in both directions. In terms of compound flows, the arrival and departure trip of each vehicle is represented as two separate trips (for example, a value of 80 represents 40 vehicle movements into the compound plus 40 vehicle movements out of the compound).

16.4.14 Table 16.4.1 shows that with the Proposed Development there will no longer be vehicle trips to/from the five compounds that are no longer required as part of the Proposed Development. The table also illustrates the reduction in trips associated with the Bromford tunnel west portal and Bromford intermediate shaft satellite compounds compared to the Phase One scheme. Also provided are the vehicle trip generations forecast to use the B4118 and M6-M42 Link

accesses of the new Bromford tunnel east portal main compound. The B4118 access will be used for worker vehicles (cars and LGVs) throughout the construction phase. During the first 12 months of construction during the initial civil engineering works up to 80 two-way lorry vehicle trips per day will also use the B4118 access. After approximately 12 months, once the M6-M42 link access becomes operational, daily lorry trips via the B4118 access will reduce to between 48-72 two-way trips per day. At this stage tunnel works will begin to use the M6-M42 Link access, which will generate up to 420- two-way lorry vehicle trips per day via the M6-M42 Link. This assessment considers the combined impact of the additional trips associated with the Bromford tunnel east portal main compound, along with the reduction in trips associated with the five compounds no longer required and the reduced trip generation of the Bromford tunnel west portal and Bromford intermediate shaft satellite compounds.

16.4.15 Construction activities at all other compounds would be unaffected by incorporation of the Proposed Development, and as a result the trips associated with those compounds would remain unchanged from those presented within the 2013 ES, as amended.

16.4.16 As noted in Section 16.2, Annual Average Traffic Data (AADT) used to inform this screening assessment has been derived from the 2013 ES, as amended, Annex D traffic data used for air quality (Volume 5). Within that data a small number of links within the study area of this assessment were not available in AADT format, comprising:

- Newport Road between A452 and B4114 Bradford Road;
- B4114 Bradford Road between Newport Road and the B4118 Hall Road;
- B4118 between B4117 Birmingham and A446 Lichfield Road;
- B4118 Water Orton Road east of Parkfield Drive;
- B4118 Birmingham Road west of B4117 Birmingham Road;
- B4117 between B4118 Marsh Lane and Gypsy Lane; and
- B4117 between Gypsy Lane and A446 Lichfield Road.

16.4.17 Traffic data for the B4118 between the B4117 and A446 Lichfield Road, and links on the B4117 between the B4118 and A446 Lichfield Road, have been derived from 12 hour manual classified turning counts provided within the 2013 ES, as amended, which have been adjusted to a 24 hour AADT value. Traffic data for Newport Road and links on the B4118 between Parkfield Drive and the B4117 have been derived from AADT traffic data provided on the DfT Road Traffic Statistics website.

16.4.18 No data was available for the B4114 Bradford Road, however as demonstrated in Appendix 16.1, the Proposed Development would be forecast to result in a decrease in traffic on the B4114 compared to the Phase One scheme, and

therefore the Proposed Development would not result in a new or different significant adverse traffic related effect compared to the Phase One scheme.

16.4.19 Appendix 16.1 provides a summary of the forecast change in daily traffic resulting from incorporation of the Proposed Development for two scenarios; during the initial 12-month period before the M6-M42 motorway link access opens, and for the period after the motorway link access is open. Forecasts are provided for the busy period and peak month of activity.

16.4.20 Appendix 16.2 provides a summary of the forecast operation of all junctions modelled within the 2013 ES, as amended, that fall within the study area of this assessment. Appendix 16.2 summarises the forecast operation of the Baseline and with Phase One scenarios, as reported in the 2013 ES, as amended, alongside the estimated junction performance of the Proposed Development scenario that represents the greatest impact at each location.

16.4.21 In relation to the Phase One scheme, the following locations will result in changes in traffic that will lead to significant increases in traffic-related severance for non-motorised users, making it more difficult to cross the road:

- Langley Drive, Castle Bromwich Business Park (minor adverse significant effect);
- Tameside Drive, Castle Bromwich Business Park (minor adverse significant effect);
- B4117 Watton Lane between the A446 Lichfield Road and Gypsy Lane (major adverse significant effect);
- The A446 Lichfield Road between the M6 Junction 4 and Faraday Avenue (major adverse significant effect); and
- The A446 Lichfield Road between Faraday Avenue and the A4091 Tamworth Road (moderate adverse significant effect);

16.4.22 On Langley Drive and Tameside Drive, the effect of the forecast increases in traffic was assessed as minor in the 2013 ES, as amended, because the pedestrian demand and total forecast traffic flows were likely to be low, so opportunities for pedestrians to cross the roads would remain. In relation to the Proposed Development, the Bromford tunnel intermediate shaft satellite compound would remain in operation for the Proposed Development. While traffic flows would therefore be lower than forecast for the Phase One scheme, on a precautionary basis the effect has been assessed as no change from the 2013 ES, as amended, i.e. minor adverse significant.

16.4.23 On Tameside Drive, the Proposed Development would no longer require the Bromford tunnel east portal (east) main compound. Traffic flows on Tameside Drive east of Langley Drive would therefore reduce as a result of the Proposed

Development to the same level as the without scheme scenario. Traffic flows on Tameside Drive west of Langley Drive would also reduce by the same amount, however there would still be an increase compared to the without scheme scenario due to trips associated with the Bromford Tunnel intermediate shaft satellite compound that will remain in operation. While traffic flows would therefore be lower than forecast for the Phase One scheme, on a precautionary basis the effect has been assessed as no change from the 2013 ES, as amended, i.e. minor adverse significant.

16.4.24 On the A446 the Proposed Development would result in changes in forecast traffic volumes, however they would not give rise to any new or different significant adverse severance effects and would not change the level of significance of the effects reported in the 2013 ES, as amended.

16.4.25 This screening assessment has identified that there would be a major adverse significant severance effect on the B4117 Watton Lane between the A446 Lichfield Road and Gypsy Lane, however the Proposed Development would not give rise to a new or different adverse effect compared with the Phase One scheme.

16.4.26 The forecast changes in traffic associated with the proposed development for links identified in Section 16.4.16 would not result in any new or different adverse significant severance effects, and would not change the level of significant effects compared with the Phase One scheme.

16.4.27 Forecast changes in traffic on all other links within the study area would not give rise to a new significant effect in relation to severance compared to the Phase One scheme.

16.4.28 As a result, taking into account the above considerations, no new or different significant adverse severance effects would be expected as a result of the Proposed Development.

16.4.29 In relation to the Phase One scheme, the following locations will result in changes in traffic that would lead to significant increases in delay and congestion to vehicle users:

- M6 / A446 Stonebridge Road junction (major adverse significant effect);
- A446 Stonebridge Road / Coleshill Heath Road junction (minor adverse significant effect);
- A446 Stonebridge Road / B4114 Birmingham Road junction (major adverse significant effect);
- A446 Lichfield Road / Gorsey Lane (minor adverse significant effect);

- A446 Lichfield Road / B4117 Watton Lane junction (minor adverse significant effect);
- A446 Lichfield Road / B4118 Marsh Lane junction (moderate adverse significant effect);
- A446 Lichfield Road / Faraday Avenue/Marsh Lane (minor adverse significant effect);
- A446 Lichfield Road / A4097 Kingsbury Road/M42 (moderate adverse significant effect); and
- A446 Lichfield Road / A4091 Tamworth Road (major adverse significant effect).

16.4.30 The construction works associated with the Phase One scheme require temporary traffic management measures for the replacement of the B4118 Water Orton Road overbridge, which is likely to result in reduced capacity and delays, however these are not expected to be significant. There are were no temporary road closures or diversions proposed on the study area links, and although minor utilities works are required for the Phase One scheme, these will be short term and will not result in significant effects.

16.4.31 In relation to the Proposed Development, the Bromford tunnel east portal main compound will operate 24 hours a day. Here, office workers will work core hours (0800-1800), meanwhile 24-hour operations staff will have shift changeovers that do not coincide with the highway peak hours. As a result, the majority of workforce trips are likely to travel outside of the peak rush hours, with staff arriving before 0800 in the morning, in advance of the morning peak 'rush hour', and departing after 1800 in the evening. However, consistent with the 2013 ES, as amended, this screening assessment has assumed a reasonable 'maximum most likely scenario' that 50% of core/office workers travel during the peak periods. The forecast additional trips to/from the Bromford tunnel east portal main compound, in combination with the forecast reductions in trips associated with other compounds, will not result in any new or different significant adverse effects on delay and congestion at junctions compared to the Phase One scheme. Temporary traffic management measures for the replacement of the B4118 Water Orton Road overbridge would no longer be required, and no additional temporary road closures, diversions or utilities works would be proposed. As a result, taking into account the above considerations, no new or different significant adverse congestion and delay effects would be expected as a result of the Proposed Development.

16.4.32 In relation to the Phase One scheme, the 2013 ES, as amended, reported that a permanent loss of approximately 200 private car parking spaces is anticipated at businesses in the vicinity of the eastern tunnel entrance portal, at the Castle Bromwich Business Park. However, the businesses associated with the car parking spaces will be displaced to facilitate the Phase One scheme, and,

therefore, the need for these spaces will not exist. No significant parking effects are therefore considered to arise. In relation to the Proposed Development, a number of the businesses identified in the 2013 ES, as amended, would no longer be operating at the Castle Bromwich Business Park, and a further number of businesses to the eastern side of Orton Way would still be in operation. As noted in the Socio-economics section of this screening report (Section 14), only one business property, the British Auctioneers site, is still required as part of the Proposed Development, and this business has already been demolished. As the remaining businesses would neither be displaced or lose car parking spaces as a result of the Proposed Development, no significant parking effects would arise. Taking into account the above considerations, the Proposed Development would not give rise to a new or different parking and loading significant adverse effect compared to the Phase One scheme.

16.4.33 In relation to the Phase One scheme, the 2013 ES, as amended, reported that the effect on accidents and safety risk is not considered to be significant. There are no locations where there were existing highway safety issues and where there will be a substantial increase in traffic during construction or operation. In relation to the Proposed Development, forecast changes in traffic flow associated with the Proposed Development would not result in significant effects on accident and safety risk; it remains the case that there are no locations where there are existing highway safety issues where there would be as substantial increase in traffic during construction. Taking into account the above considerations, the Proposed Development would not give rise to a new or different accident and safety significant adverse effect compared to the Phase One scheme.

16.4.34 In relation to the Phase One scheme, the 2013 ES, as amended, reported that it was not expected that the construction of the Phase One scheme will require bus route diversions within the study area. Rail possessions will be required within the area, however these will be limited to overnight, off-peak or weekend periods where reasonably practical, and as a result no significant effects are expected. In relation to the Proposed Development it would remain the case that bus route diversions would not be required, and no additional rail possessions would be expected as a result of the Proposed Development. As a result, taking into account the above considerations, no new or different significant adverse public transport delay effects are expected.

16.4.35 In relation to the Phase One scheme, the 2013 ES, as amended, reported that it is not expected that footways will need to be diverted or closed during the construction of the Phase One scheme within the study area. In relation to the Proposed Development it would remain the case that footways would not need to be diverted or closed. Taking into account the above considerations, the Proposed Development would not give rise to a new or different vulnerable user

delay, amenity and ambience significant adverse effect compared to the Phase One scheme.

Other mitigation and residual effects

16.4.36 The implementation of the CoCP in combination with the construction workforce travel plan would, to some degree, mitigate the transport related effects during construction of the Proposed Development. The reductions in effects arising from the travel plan measures were not included in the assessment Phase One scheme, as reported in the 2013 ES, as amended, which would mean that adverse effects may be over-stated. This screening reported for the Proposed Development has adopted the same approach, and as such the adverse effects assessed may be similarly over-stated.

16.4.37 No additional mitigation measures (i.e. in addition to those identified in Section 16.4.1 and 16.4.2 would be required, and the effects of the Proposed Development are as described above. As a result, the likely residual significant effects remain as reported above.

Cumulative effects

16.4.38 As identified in Section 2 of this report, a new electrical substation would be required as part of the Proposed Development in order to provide traction power for the railway and this would be constructed by Western Power Distribution following completion of the Proposed Development. However, the base of the substation would be constructed as part of the Proposed Development and therefore the associated highway trips are accounted for within the volumes presented in this screening assessment. The substation would be a precast unit and would generate an additional four to six two-way trips in total (i.e. cumulative, not daily). The number of additional daily two-way trips associated with installation of the substation is considered to be unlikely to result in a new or different adverse significant cumulative effect, as compared with the Phase One scheme.

16.4.39 The assessment has taken into account background traffic growth and includes in-combination effects by taking into account traffic and transport impacts of HS2 works being undertaken throughout the Coleshill Junction area (CFA19), Cudworth to Middleton area (CFA20), Castle Bromwich and Bromford area (CFA25), plus adjacent areas including Balsall Common and Hampton-in-Arden area (CFA23), Birmingham Interchange and Chelmsley Wood area (CFA24) and Washwood Heath to Curzon Street area (CFA26).

16.5 Effects arising during operation

Avoidance and mitigation measures

16.5.1 No additional avoidance and mitigation measures (i.e. in addition to those identified in the 2013 ES, as amended) are required.

16.5.2 As identified in Section 2 of this report, the measure to avoid or reduce impacts on transport users previously identified in the 2013 ES, as amended, in the form of the replacement Water Orton Road overbridge, will no longer be required.

Assessment of impacts and effects

16.5.3 The following section considers the impacts on traffic and transport and the consequential effects resulting from the operational phase of the Proposed Development.

16.5.4 In relation to the Phase One scheme, the 2013 ES, as amended, reported that a significant major beneficial effect is forecast for rail passengers in Castle Bromwich and Bromford (CFA25), benefiting from an increase in rail capacity and from improved journey times between Birmingham and London through convenient access to stations at Birmingham interchange (CFA24) and Curzon Street (CFA26). Significant major beneficial effects are also expected for local commuters due to the release capacity on the existing classic rail network, including reduced crowding and the potential for additional services. In 2026 and 2041 the primary benefits forecast were shorter journey times, increased reliability, reduced crowding, support for options for growth and increased access to wider national rail destinations. In relation to the Proposed Development, the Bromford tunnel would be extended but would result in no change to the public transport delay effects attributed to the Phase One scheme. The effect has therefore been assessed as no change from the 2013 ES, as amended, i.e. major benefit significant.

16.5.5 In relation to the Phase One scheme, the 2013 ES, as amended, reported that in 2041 traffic flows are expected to be similar to those compared to without the Phase One scheme. The only changes to traffic would be occasional traffic that may access areas of the Phase One scheme for maintenance purposes. However, these infrequent vehicle movements were expected to be very low and would therefore have no significant effect, including no effects on travel times for non-motorised users. The Phase One scheme includes stations at Curzon Street (in Birmingham city centre), and at Birmingham Interchange (in Solihull), both of which are located in nearby CFAs. Whilst traffic and transport effects due to passengers alighting and departing HS2 services are concentrated around the station locations, traffic will travel through the study area to access the stations. As a result, there will be an increase in traffic flows on the A47 Fort Parkway, A38

Tyburn Road and A452 Chester Road. The forecast distribution of trips to the proposed stations results in vehicle trips being spread out across several routes and, therefore, the effect on the routes within this area were not forecast to be significant.

16.5.6 In relation to the Proposed Development, it would continue to be the case that the Proposed Development will generate limited vehicular trips. No replacement bridge over Water Orton Road would be required for the Proposed Development, however operationally this would result in no change to forecast traffic flows or effects assessed within the 2013 ES, as amended. As a result, taking account of the above considerations, no new or different significant adverse effects in relation to traffic flow and delay to vehicle occupant effects would be expected.

16.5.7 In relation to the Phase One scheme, the 2013 ES, as amended, reported a permanent loss of approximately 200 private car parking spaces at businesses in the vicinity of the eastern tunnel entrance portal, at Castle Bromwich Business Park. However, the businesses associated with the car parking spaces will be displaced to facilitate the Phase One scheme and, therefore, the need for these spaces will not exist. No significant parking effects are therefore expected to arise. In relation to the Proposed Development, a number of the previously identified businesses are no longer operating at the Castle Bromwich Business Park, and a further number of businesses to the eastern side of Orton Way are still in operation. The intermediate shaft would be located on a vacant plot, which would not result in the loss of parking spaces. As the remaining businesses would neither be displaced or lose car parking spaces due to the Proposed Development, no significant parking effects would arise. Taking into account the above considerations, the Proposed Development would not give rise to a new or different significant adverse effect in relation to parking and loading.

16.5.8 In relation to the Phase One scheme, the 2013 ES, as amended, reported that no significant effects are forecast within the study area on disruption at stations / interchanges, vulnerable road user delays, accidents and safety, severance and waterways. In relation to the Proposed Development, the creation of the new east portal would generate a limited number of maintenance trips, however these would be low in number and infrequent and as such would result in no change to the forecast traffic flows or effects reported in the 2013 ES, as amended. As a result, taking account of the above considerations, the Proposed Development would not give rise to new or different significant adverse effects within these assessment criteria.

Other mitigation and residual effects

16.5.9 No additional mitigation measures (i.e. in addition to those identified in the 2013 ES, as amended) are required. As a result, the likely residual significant effects would remain as reported above.

Cumulative effects

16.5.10 The assessment includes the cumulative effects of planned development during operation by taking this into account within the background traffic growth.

16.5.11 The assessment has taken into account traffic and transport movements which pass through the area to access the proposed stations at Curzon Street (CFA26) and Birmingham Interchange (CFA24) and the proposed Washwood Heath depot (CFA26).

16.5.12 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

16.6 Summary

16.6.1 In relation to traffic and transport, no new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme. The Proposed Development would remove five construction compounds and associated lorry and other vehicle movements that were needed for the Phase One Scheme. In addition, tunnel operations would be driven from the east portal instead of the west portal, with the main access and egress for heavy goods vehicles to the east portal taken directly from the M6-M42 Link Road. The combined impact of these changes would not result in any new or different significant adverse effects, as compared with the Phase One scheme. The most intensive peak periods of construction in relation to the Proposed Development would result in localised increases in traffic, however such increases would not be significant and would not result in new or different significant adverse effects compared with the Phase One Scheme. Operationally, the Proposed Development would provide the same increased capacity on train services and substantial reductions in journey times between Birmingham and London as reported in the 2013 ES, as amended. This would result in beneficial transport effects, as is consistent with the Phase One scheme.

17 Waste and material resources

17.1 Introduction

17.1.1 This section of the report presents the likely significant adverse environmental effects associated with the off-site disposal of solid waste that will be generated by the Proposed Development as compared to the Phase One scheme. This assessment considers:

- the types and quantity of waste that will be generated;
- the quantity of waste that will require off-site disposal to landfill; and
- the availability of off-site landfill disposal capacity.

17.2 Scope assumptions and limitations

17.2.1 The assessment scope, key assumptions and limitations for the waste and material resources assessment are as set out in Volume 3: Route-wide effects, the SMR (Volume 5, Appendix: CT-001-000/1) and the SMR Addendum (Volume 5, Appendix: CT-001-000/2) of the 2013 ES, as amended.

17.2.2 To reflect the broader county and regional-based approach to waste planning and management, the 2013 ES, as amended, undertook an assessment of the likely significant environmental effects associated with the off-site disposal to landfill of solid waste on a route-wide basis. This route-wide approach took into account waste arisings and waste infrastructure capacity data available at county and regional levels. The purpose and scope of the 2013 ES, as amended, limited the information considered for the future baseline to landfill disposal capacity only. This waste and material resources screening assessment has applied the same approach by assessing likely significant environmental effects on a route-wide basis, but the assessment has also presented the waste arisings and waste infrastructure capacity available for the West Midlands, the region relevant to the Proposed Development, to provide an indication of predicted likely effects at the regional scale. The assessment adheres to the rationale underpinning the significance criteria for inert, non-hazardous and hazardous landfill, as set out by the SMR addendum of the 2013 ES, as amended (Volume 5: Appendix CT-001-000/2).

17.2.3 Section 2 of this report provides a description of the Proposed Development. Key changes from the Phase One scheme that are relevant to waste and material resources assessment, are as follows:

- extension of Bromford tunnel from Castle Bromwich Business Park to the Water Orton area, including tunnelling activities to be undertaken for boring

the twin tunnels and the associated construction and excavation activities required for the Bromford tunnel east portal and associated infrastructure located southwest of Water Orton; and,

- replacement of Bromford tunnel east portal and other ancillary infrastructure with Bromford tunnel intermediate shaft at Castle Bromwich Business Park, including the required construction, demolition and earthworks activities.

17.2.4 The 2013 ES, as amended, estimated the quantity of commercial and industrial waste arisings to be generated by worker accommodation sites using a generation rate of tonnes per worker per month, according to the number of workers to be accommodated and the duration of the occupation. The Proposed Development will not alter the worker accommodation sites assessed in the 2013 ES, as amended, and therefore this screening assessment will not take into account the commercial and industrial waste arisings generated by worker accommodation sites.

17.2.5 The 2013 ES, as amended, estimated the quantity of construction waste to be generated by the Phase One scheme using a generation rate of tonnes per amount of construction financial spend. Given that the construction spend of the Proposed Development will not exceed the construction spend of the corresponding section of the Phase One scheme, the Proposed Development would not result in new or different significant adverse effects in respect of construction waste and therefore this matter is not considered further.

17.2.6 The revised forecasted excavated material quantities for the Proposed Development are based on the calculated figures for the integrated earthworks design and reflect the balance of excavated material across the Proposed Development. These quantities indicate that the excavated material arising from the Proposed Development will be diverted from off-site disposal and reused on-site for environmental mitigation earthworks purposes where appropriate and suitable. However, as a reasonable worst-case approach, it is assumed that the excavated material quantities generated at the Bromford tunnel intermediate shaft site will require off-site disposal as hazardous waste, given that excavation will be undertaken within and in proximity to former landfill sites, see Section 11 of this report for further detail. Additionally, the slight decrease in excavated material produced as a result of the reduction in size of the Water Orton cutting for the Proposed Development, as described in Section 2 of this report, has not been included in the revised excavated material quantities to ensure a reasonable worst-case approach.

17.2.7 The quantity of demolition material generated by the Proposed Development has been estimated using the Waste and Resources Action Programme

'Demolition bill of quantities estimator'[53], which uses the basic dimensions and typology of buildings to be demolished. The quantity of demolition material that will be diverted from landfill via reuse, recycling and recovery is based on a landfill diversion rate of 90%, as stated in Volume 3: Route-wide effects of the 2013 ES, as amended. It has been assumed, as a reasonable worst-case scenario for the purpose of this assessment, that the remaining 10% of demolition material and construction waste that will be generated will be disposed of off-site to landfill. For the purpose of this assessment, it has been assumed that 60% of the quantity of demolition waste requiring off-site disposal to landfill will be non-hazardous waste and 40% will be hazardous waste, as stated in Volume 3: Route-wide effects of the 2013 ES, as amended.

17.2.8 The 2013 ES, as amended, estimated the quantity of waste associated with the operation of the Phase One scheme. The quantity of operational waste is not expected to change as a result of the Proposed Development, and therefore this matter is not considered further.

17.3 Environmental Baseline

Existing baseline

17.3.1 Baseline information for existing environmental conditions, specifically for the arisings and management of construction, demolition and excavation waste (CDEW), remain unchanged from that described and assessed in Volume 3 and Volume 5 of the 2013 ES, as amended.

Future environmental baseline

Construction

17.3.2 Relevant future baseline information provided within the 2013 ES, as amended by subsequent SESs and AP ESs, is provided in Table 17.3.1 below. Corresponding calculations and other supporting material are found within Volume 3 and Volume 5 of the 2013 ES, as amended. The future baseline information presented for the 2013 ES, as amended, is based on permitted capacity for all types of waste treatment and disposal facilities, published by the Environment Agency. The future baseline information has been compared against the most recent permitted capacity data, published by the Environment Agency[54], and has been determined to be suitable to inform the future baseline used in this assessment.

[53] Waste & Resources Action Programme (2020), Net Waste Tool. Available at: http://nwtool.wrap.org.uk/ (*Accessed 25 August 2020*)
[54] Latest available data that has been presented in the same format, allowing for a direct comparison against the future baseline conditions reported in the 2013 ES, as amended, published for 2018 and available at: https://data.gov.uk/dataset/312ace0a-ff0a-4f6f-a7ea-f757164cc488/waste-data-interrogator-2018 (*Accessed on 24 August 2020*)

Table 17.3.1 Future baseline for the 2013 ES, as amended, of landfill capacity projection to 2025

Class of Landfill	Total forecast capacity 2025, end of construction, across all five regional planning areas (tonnes)
Inert	118,799,339
Non-Hazardous	104,456,766
Hazardous	1,109,312

Operation

17.3.3 The 2013 ES, as amended, projected waste infrastructure capacity for the first year of operation of the Phase One scheme. However, the quantity of operational waste is not expected to change as a result of the Proposed Development, and therefore this matter is not considered further.

17.4 Effects arising during construction

Avoidance and mitigation measures

17.4.1 Avoidance and mitigation measures described in Volume 3 of the 2013 ES, as amended, remain applicable to the Proposed Development. The key measures described in the 2013 ES, as amended, that are relevant to the Proposed Development include;

- management of construction, demolition and excavation waste generated by the Proposed Development will be subject to EMRs contained within the corresponding suite of documents which sit in conjunction with the 2017 Act;
- measures set out in the CoCP, which provide effective planning, management and control of during construction;
- an integrated design approach has been developed that seeks to minimise the quantity of surplus excavated material generated, reuse that which is generated to satisfy the necessary engineering and environmental mitigation earthworks requirements for the Proposed Development and minimise off-site disposal to landfill; and
- a site waste management plan, as well as other environmental controls agreed with regulatory authorities and set out in local environmental management plans, environmental management systems and procedures for measurement and monitoring, auditing and record-keeping.

Assessment of impacts and effects

17.4.2 Calculation methodologies, assumptions, and other supporting material for the waste and material resources effects of the Phase One scheme are found within Volume 3 and Volume 5 of the 2013 ES, as amended. Waste and material resources effects of the Proposed Development are set out in Table 17.4.1, Table 17.4.2, and Table 17.4.3.

Table 17.4.1 Material and waste quantities that will be generated by excavation and demolition of the Phase One scheme and the Proposed Development, 2017 to 2025

Source		Total quantity of material (tonnes)	Quantity diverted from landfill (tonnes)	Quantity of surplus excavated material for sustainable placement (tonnes)	Quantity for off-site disposal to landfill
Excavation	Phase One scheme: West Midlands[55]	58,483,996	58,167,745[56]	0	316,251[57]
	Proposed Development: West Midlands	58,647,197	58,306,491	0	340,706 (8% increase)
	Phase One scheme: Total across five regions[58]	130,538,618	112,274,011	4,781,611	13,482,996
	Proposed Development: Total across five regions	130,701,819	112,412,757	4,781,611 (no change)	13,507,451 (<1% increase)
Demolition	Phase One scheme: West Midlands[59]	888,279	799,451	0	88,828
	Proposed Development: West Midlands	869,459	782,513	0	86,946 (approx. 2% decrease compared to Phase One scheme)
	Phase One scheme: Total	1,727,876	1,555,088	0	172,788

[55] Based on Table 2a and Table 2c in WM-001-000 Annex 1 of Volume 5 of the SES 3 and AP 4 ES
[56] Regional quantities aggregated across all five regions by the 2013 ES, however, estimate for West Midlands presented for indication of scale and calculated by subtracting quantity of material for off-site disposal from total quantity of material, as presented in the 2013 ES, as amended
[57] Regional quantities aggregated across all five regions by the 2013 ES, however, estimate for West Midlands presented for indication of scale and calculated by aggregating the forecast quantities for Unacceptable material (U1B) for disposal as non-hazardous waste and Unacceptable material (U2) for disposal as hazardous waste, as presented in the 2013 ES, as amended
[58] Table 14 in Section 19.6 of Volume 3 of the SES 3 and AP 4 ES
[59] Table 10 and Table 12 in Section 19.6 of Volume 3 of the SES 3 and AP 4 ES

Source		Total quantity of material (tonnes)	Quantity diverted from landfill (tonnes)	Quantity of surplus excavated material for sustainable placement (tonnes)	Quantity for off-site disposal to landfill
	across five regions[60]				
	Proposed Development: Total across five regions	1,709,056	1,538,150	0	170,906 (approx. 1% decrease compared to Phase One scheme)

Table 17.4.2 Quantity of waste requiring off-site disposal and waste landfill capacity projection to 2025 for the Phase One scheme and Proposed Development

Class of Landfill		Total quantity for off-site disposal, 2017 to 2025 (tonnes)[61]	Forecast capacity 2025 (tonnes)[62]	Proportion of landfill capacity drawdown
Inert	Phase One scheme	12,573,420	118,799,339	11%
	Proposed Development	12,573,420	118,799,339	11%
Non-Hazardous	Phase One scheme	852,562	104,456,766	0.8%
	Proposed Development	851,433	104,456,766	0.8%
Hazardous	Phase One scheme	539,193	1,109,312	49%
	Proposed Development	562,895	1,109,312	51%

[60] Section 19.6 of Volume 3 of the SES 3 and AP 4 ES
[61] Section 19.6 of Volume 3 of the SES 3 and AP 4 ES
[62] Section 3.3 of WM-001-000 Annex 1 of Volume 5 of the SES 3 and AP 4 ES

Table 17.4.3 Quantity of waste requiring off-site disposal and waste landfill capacity effects for the Phase One scheme and Proposed Development

Class of Landfill		Total quantity for off-site disposal, 2017 to 2025 (tonnes)[63]	Total quantity for off-site disposal, tonnes per annum[64]	Significance Criteria
Inert	Phase One scheme	12,573,420	2,514,684	moderate adverse
	Proposed Development	12,573,420	2,514,684	moderate adverse (no change)
Non-Hazardous	Phase One scheme	852,562	94,729	moderate adverse
	Proposed Development	851,433	94,603	moderate adverse (no change)
Hazardous	Phase One scheme	539,193	269,597	major adverse
	Proposed Development	562,895	281,448	major adverse (no change)

Other mitigation and residual effects

17.4.3 Other mitigation measures described in Volume 3 of the 2013 ES, as amended, remain applicable to the Proposed Development.

17.4.4 A reasonable worst-case approach has been taken in determining the quantity of hazardous waste for off-site disposal to landfill. However, detailed chemical sampling and laboratory analysis, as part of future ground investigation works, may allow the hazardous waste to be reclassified as non-hazardous waste. This will reduce reliance on hazardous waste landfill capacity.

Cumulative effects

17.4.5 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

[63] Section 19.6 of Volume 3 of the SES 3 and AP 4 ES

[64] Consistent with the 2013 ES, as amended, a constant rate of surplus excavated material generation has been assumed over the first five years of construction. A constant rate of waste generation has been assumed for non-hazardous waste throughout the nine-year construction period. As a conservative assumption, the hazardous waste will be generated predominantly within the first two years of construction.

17.5 Effects arising during operation

Avoidance and mitigation measures

17.5.1 Avoidance and mitigation measures described in Volume 3 of the 2013 ES, as amended, remain applicable to the Proposed Development, however the quantity of operational waste is not expected to change as a result of the Proposed Development.

Assessment of impacts and effects

17.5.2 The 2013 ES, as amended, estimated the quantity of waste associated with the operation of the Phase One scheme. The quantity of operational waste is not expected to change as a result of the Proposed Development, and therefore this matter is not considered as part of this screening assessment.

Other mitigation and residual effects

17.5.3 No other mitigation measures are proposed as part of this screening assessment and therefore effects are as reported above.

Cumulative effects

17.5.4 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

17.6 Summary

17.6.1 No new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme.

17.6.2 The Proposed Development would not result in any waste and material resources effects that are greater than those reported in relation to the Phase One scheme, such that no new or different significant adverse effects would arise as a result of the Proposed Development. The key difference between the Proposed Development and the Phase One scheme is that the extension of the tunnel would result in an increase of excavated material quantities. However, these excavated materials would be diverted from off-site disposal, as proposed in the case of the Phase One scheme, and reused on-site for environmental mitigation earthworks purposes, where appropriate and suitable, in the case of the Proposed Development. Compared with the Phase One scheme, there would be an increase in hazardous material requiring off-site disposal for the Proposed Development, due to excavation for the Bromford tunnel intermediate shaft within a former landfill site, however the quantity of material would not result in a new of different significant effect compared to the Phase One scheme as

excavation for the Phase One scheme east tunnel portal would occur within the same former landfill site. The Proposed Development would result in a decrease in material arising from demolition, in turn reducing the requirement for off-site disposal of demolition waste to landfill.

17.6.3 Summaries of the waste and material resources effects resulting from f the Proposed Development, as compared with those resulting from the Phase One scheme, are set out in Table 17.6.1 below.

Table 17.6.1 Effects of waste requiring off-site disposal on landfill capacity effects for the Phase One scheme and Proposed Development

Class of Landfill Capacity		Residual significant effects
Inert	Phase One scheme	moderate adverse
	Phase One with Proposed Development	moderate adverse (no change)
Non-Hazardous	Phase One scheme	moderate adverse
	Phase One with Proposed Development	moderate adverse (no change)
Hazardous	Phase One scheme	major adverse
	Phase One with Proposed Development	major adverse (no change)

18 Water resources and flood risk

18.1 Introduction

18.1.1 This section provides a description of the baseline for water resources and flood risk for the Proposed Development. Any new or different significant adverse effects of the Proposed Development, compared to the 2013 ES, as amended, are then assessed.

18.1.2 This section of the report considers the following aspects of the water environment:

- effects on surface water of the proposed works;
- effects on groundwater of the proposed works; and
- flood risk caused by the proposed works, that includes fluvial, pluvial and groundwater flooding.

18.2 Scope assumptions and limitations

18.2.1 The assessment scope, key assumptions and limitations for water resource and flood risk assessment are as 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) of the 2013 ES, as amended. This water resources and flood risk assessment has applied the same assessment approach. As is consistent with the approach to flood risk set out in the 2013 ES, as amended (Volume 5, Appendix: WR-003-025), the assessment has been carried out in accordance with the requirements of the National Planning Policy Framework (NPPF)[65], which aims to prevent inappropriate development in areas at risk of flooding and to ensure that, where development is necessary in areas at risk of flooding, it can occur without risk to the development or to third parties.

18.2.2 Separate Water Framework Directive (WFD) compliance, Flood Risk Assessments (FRA), and Groundwater Risk Assessments (GWRA) have not been produced for this report, which is considered proportionate to this screening level of assessment.

18.2.3 The spatial scope for this report includes surface and groundwater features within 1km of the centre line of the Proposed Development.

[65] Ministry of Housing, Communities and Local Government (2019) National Planning Policy Framework

18.3 Environmental Baseline

Existing baseline

18.3.1 Relevant baseline information contained within the 2013 ES, as amended, is provided below. Table 18.4.1, Table 18.4.2, and Table 18.4.3 provide summaries of baseline information in respect of surface and groundwater water resources and flood risk, as relevant to the Proposed Development. In relation to surface water, ponds have not been included; refer to Ecology assessment (Section 10).

18.3.2 Detailed descriptions and tables of existing surface water and groundwater resources are provided in Volume 5 Technical Appendices[66], Water Resources Assessment WR-002-19[67] and WR-002-25[68] of the ES, as amended. This section briefly summarises the detail presented in the above document and identifies any new baseline conditions to be taken into account.

Surface water

Table 18.4.1 Surface Water baseline

Surface Water Receptors	Receptor Value	Description / comments
Drain to River Cole	Moderate	Minor watercourse located to south-east of proposal, not likely to be affected
River Cole ((River Cole from Hatchford-Kingshurst Brook to River Blythe (GB104028042420))	High	WFD waterbody catchment, located to south-east of proposal, not likely to be affected
Tributary of River Tame (Water Orton)	Moderate	Minor watercourse located south of Water Orton, culverted at M42 and discharging to Tame at Coleshill, not likely to be affected

[66] Available at: https://webarchive.nationalarchives.gov.uk/20140613022448/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/water/Volume_5_Water_resources_routewide_appendix_WR-001-000.pdf; https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/444116/Volume_5_Water_resources__WR-001-000_.pdf

[67] Available at: https://webarchive.nationalarchives.gov.uk/20140613023147/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/water/WR-002-019.pdf; https://webarchive.nationalarchives.gov.uk/20140613023153/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/water/WR-003-019.pdf;

[68] Available at: https://webarchive.nationalarchives.gov.uk/20140613023558/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/water/Vol5_CFA25_Water_resources_Water_resources_assessment_WR-002-025.pdf; https://webarchive.nationalarchives.gov.uk/20140613023605/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/water/Vol5_CFA25-Water_resources_Flood_risk_assessment_WR-003-025.pdf; https://webarchive.nationalarchives.gov.uk/20140613023620/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/water/Vol5_CFA2526_Water_resources_Initial-groundwater_model_report_WR-004-020.pdf; https://webarchive.nationalarchives.gov.uk/20140613023630/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/water/Vol5_CFA2526_Water_Resources_River_modelling_of_the_River_Tame_tech_WR-004-019.pdf; https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/466964/Water_resources__WR-002-009__WR-002-025__WR-003-023__WR-003-025__WR-001-000_.pdf

Surface Water Receptors	Receptor Value	Description / comments
Drain feeder to River Tame (Parkhill)	Moderate	Drain flowing to pond and discharging to Tame at Parkhill Wood, not likely to be affected
River Tame (Tame – confluence two arms to River Rea (GB104028046842))	High - Very high	WFD waterbody catchment, with the River Tame located adjacent to the proposed tunnel extension, as part of the Proposed Development. Current overall WFD status: Moderate (2019)[69]
River Tame (Tame – River Rea to River Blythe (GB104028046841))	High - Very high	WFD waterbody catchment, with the River Tame located directly above the proposed tunnel extension, as part of the Proposed Development. Current overall WFD status: Moderate (2019)[70]
Plants Brook (Plants Brook Catchment (trib of Tame (GB104028046860))	High	WFD waterbody catchment. Extensively culverted channel located in Castle Vale joining the River Tame above the location of the proposed tunnel extension, as part of the Proposed Development. Current overall WFD status: Moderate (2019)[71]
Dunlop Channel	High	Highly engineered channel located north of Castle Bromwich Business Park joining the River Tame above the location of the proposed tunnel extension, as part of the Proposed Development.

18.3.3 No additional surface water receptors have been identified. Changes in the boundaries of WFD waterbody catchments since publication of the 2013 ES, as amended have been included in the table above.

Groundwater

Table 18.4.2 Groundwater baseline

Groundwater Receptors	Receptor Value	Description / comments
Aquifers - Superficial deposits		
Alluvium – Secondary A aquifer	Moderate	The Alluvium is present in the topographically low valley bottom and adjacent to existing water courses. The proposed intermediate shaft, as part of the Proposed

[69]Catchment Data Explorer, available at: https://environment.data.gov.uk/catchment-planning/WaterBody/GB104028046842
[70]Catchment Data Explorer, available at: https://environment.data.gov.uk/catchment-planning/WaterBody/GB104028046842 and https://environment.data.gov.uk/catchment-planning/WaterBody/GB104028046841
[71] Catchment Data Explorer, available at: https://environment.data.gov.uk/catchment-planning/WaterBody/GB104028046860

Groundwater Receptors	Receptor Value	Description / comments
		Development, is the only area of the Proposed Development that sits within this aquifer.
Glaciofluvial deposits – Secondary A aquifer	Moderate	The Glaciofluvial deposits are situated within the Bromford tunnel east portal site, as part of the Proposed Development. There are also outcrops on the southern side of the Tame valley. The M6 motorway has cut through the Glaciofluvial deposits in this area, indicating these are relatively thin deposits.
Head deposits – Secondary (Undifferentiated) aquifer	Moderate	The Head deposits are located within the proposed Bromford tunnel east portal site. Ground investigation information collected by HS2 Ltd has been interpreted to indicate the superficial deposits are more likely to be Glaciofluvial Deposits in the east portal location, rather than Head.
Aquifers - Bedrock Deposits		
Sidmouth Formation (Mercia Mudstone Group) – Secondary B aquifer	Moderate	The Sidmouth Formation is largely made up of mudstones with some siltstones in its unweathered state. Where it has been subject to weathering it becomes more clay like in its constituency
Surface water/Groundwater interactions		
River Tame	High	The proposed intermediate shaft, as part of the Proposed Development, lies 100m south of the river. In this area the Alluvium is expected to be in hydraulic connection with the nearby river and it is likely groundwater is flowing through the Alluvium and feeding into the river.
Spring at water treatment works at Water Orton	No value given in the original ES but likely to be Moderate	Located 683m north of the Bromford tunnel east portal, which forms part of the Proposed Development. Feeds into an unnamed ditch which joins the River Tame further east. No identified geological reason for emergence of spring. It should be noted that this feature may be a drainage feature and not necessarily a spring.
Pools 995m north west of the Bromford Tunnel east portal	No value given in the original ES but likely to be Moderate	Not known if the pools are groundwater fed or are rainfed. The fact that some do not seem to be connected to any discharge feature indicates that these are likely to be rainfed.
Water dependant habitats		
Park Hall SINC	Moderate	Ancient wetland and semi-natural woodland habitat located 540m north west of the Bromford tunnel east portal, as part of the Proposed Development. Close proximity to the River Tame and character of the superficial deposits leads to an assumed connection through permeable superficial deposits.
Castle Bromwich Local Wildlife site (LWS)	Moderate	Marshy grassland habitat located 684m south west of the intermediate shaft, as part of the Proposed

Groundwater Receptors	Receptor Value	Description / comments
		Development. Assumed connection through permeable superficial deposits.
Permitted discharges to surface water		
Consented discharge to the River Tame (Ref: Tsc3210)	Not captured in the original ES but likely to be Moderate	Located 660m north east of the shaft, the discharge relates to sewage discharge (pumping station) and is currently operated by Severn Trent Water Limited (Ltd).
Consented discharge to the River Tame (Ref: T/10/10062/T)	Not captured in the original ES but likely to be Moderate	Located 485m south east of the shaft, the discharge relates to trade effluent discharge (site drainage) and is currently operated by Tyseley Waste Disposal Ltd.
Consented discharge to the Plant Brook (Ref: T/10/22951/O/1	Not captured in the original ES but likely to be Moderate	Located 855m north east of the shaft, the discharge relates to sewage effluent and is currently operated by Severn Trent Water Ltd.
Consented discharge to the Plant Brook (Ref: T/10/10249/T/2	Not captured in the original ES but likely to be Moderate	Located 615m east of the shaft, the discharge relates to trade effluent and is currently operated by Birmingham City Council.

Water Framework Directive Status

18.3.4 Superficial deposits within the area of study are not classified as a groundwater body by the Environment Agency but may be hydraulically connected to the WFD bedrock aquifers.

18.3.5 The bedrock aquifer within which the tunnel extension and east portal, as part of the Proposed Development, are located is in the groundwater body called the Tame Anker Mease Secondary Combined body (reference number GB40402G990800). This has an overall water body status of Good (2019) according to the Environment Agency website.

Abstractions and permitted discharges

18.3.6 There has been no change since the 2013 ES, as amended, on abstractions and discharges to groundwater. Information available to HS2 Ltd from the Environment Agency and other public bodies indicates that there are still no licensed groundwater abstractions or discharges to groundwater within the study area. There are no Source Protection Zones in the study area. Four active permitted discharges to surface water were found within a 1km radius of the shaft, the consents are detailed in Table 18.4.2.

18.3.7 There could be unlicensed abstractions (i.e. abstraction <20 cubic metres per day) in the area which are not identified.

Flood risk

18.3.8 Based on previous data presented in Volume 2 of the 2013 ES, as amended, and the Environment Agency's (EA) flood risk map for planning, an overview of the current baseline flood conditions is presented below.

Table 18.4.3 Flood Risk baseline

Flood Risk Receptors	Receptor Value	Description / comments
Fluvial – River Tame	Very High (Flood Zone 3: 1% AEP or greater chance of flooding and 3b: Functional floodplain)	River Tame is assigned a main river status by the Environment Agency. Functional floodplain in vicinity identified as flood storage during high flow events at Parkhill nature reserve on right floodplain between Haywards Industrial Park and existing WCML crossing (approximately 1.2km downstream).
Fluvial – Plants Brook	High (Flood Zone 3: 1% AEP or greater chance of flooding)	Ordinary watercourse. Localised flooding at downstream extent at confluence with River Tame approximately 700m north east of ventilation shaft.
Fluvial – Dunlop Channel	High (Flood Zone 3: 1% AEP or greater chance of flooding)	Ordinary watercourse. Not shown to be a source of significant flooding with flood extents contained immediate to channel. Identified as "Area benefitting from flood defences".
Surface Water Flooding	Medium	Small pockets of high risk flooding from surface water (>3.3%AEP chance of flooding) but generally identified high risk flow routes are shown to follow existing watercourses.
Groundwater Flooding	Low	No historical accounts of groundwater flooding within the area.
Reservoir, canal and other sources of flooding	Low	Online EA "Long term flood risk map" indicates maximum extent of flooding would impact all three identified watercourses. Under the Reservoirs Act 1975, the EA ensures that reservoirs are inspected regularly by reservoir safety panel engineers and that essential safety works are carried out. The chance of this occurrence is rare and deemed to be a low risk.

Future environmental baseline

Construction

18.3.9 The committed development of the Bromford and Castle Vale Flood Risk Management Scheme (reference 2019/02210/PA), which will add additional flood walls and embankments to the land along the River Tame, has been considered in relation to this screening assessment.

Operation

18.3.10 The committed development of the Bromford and Castle Vale Flood Risk Management Scheme (reference 2019/02210/PA), which will add additional flood walls and embankments to the land along the River Tame, has been considered in relation to this screening assessment.

18.4 Effects arising during construction

Avoidance and mitigation measures

18.4.1 The Proposed Development includes embedded measures to mitigate effects on water resource or flood risk receptors. In addition, ongoing design and construction of the Proposed Development will be undertaken in accordance with the EMRs, including the Code of Construction Practice, contained within the corresponding suite of documents that sit alongside the 2017 Act, with which HS2 Ltd must comply. Construction phase measures include:

- containment measures around stationary construction plant to retain any leakage of oil or fuel and reduce the risk of surface water or groundwater pollution;
- provision of spill kits where appropriate;
- use of oil interceptors, if required, at site offices and work compounds;
- appropriate measures such as use of bunds of non-erodible material or silt or sediment fences adjacent to watercourses;
- measures to ensure that there will be no effect on surface water quality or flows associated with construction;
- 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

Surface water

18.4.2 There is potential for significant temporary effects on multiple watercourse receptors related to water quality risks arising during construction, all of which would be mitigated by following the CoCP. There is no change in the effects for the Proposed Development compared to the Phase One scheme.

18.4.3 A potential positive effect on Water Framework Directive for River Tame and Plants Brook was identified in Volume 5 WR-001-000[72], arising from the proposed realignments of the River Tame and Plants Brook giving opportunity to

[72] Available at: https://webarchive.nationalarchives.gov.uk/20140613022448/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/water/Volume_5_Water_resources_routewide_appendix_WR-001-000.pdf; https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/444116/Volume_5_Water_resources__WR-001-000_.pdf

improve existing habitats as part of the Phase One Scheme. Under the Proposed Scheme those beneficial effects are no longer relevant as the river realignments are not required.

18.4.4 The 2013 ES, as amended, identified no other significant temporary or permanent effects from the Phase One scheme.

18.4.5 No other significant temporary or permanent effects from the Proposed Development have been identified.

Groundwater

18.4.6 The 2013 ES, as amended, did not identify any significant temporary or permanent effects resulting from the Phase One scheme. Effects that were identified are set out in Table 18.5.1.

Table 18.5.1 Groundwater effects of the Phase One scheme

Groundwater Receptors	Construction effects
Secondary aquifers (superficial deposits and Mercia Mudstone Group)	Impacts from temporary dewatering works are considered negligible based on the mitigation measures set out in the CoCP (concerning wastewater and groundwater best practice measures) - not significant

18.4.7 Effects from the Proposed Development are highlighted in Table 18.5.2.

Table 18.5.2 Groundwater effects arising from incorporation of the Proposed Development

Groundwater Receptors	Construction effects
Bromford tunnel extension	
Secondary aquifers (superficial deposits and Mercia Mudstone Group)	The tunnel extension will be bored through low permeability Mercia Mudstone with a tunnel boring machine (TBM). Dewatering will not be required and effects on the groundwater quantity and quality are negligible, and thus not significant
Bromford tunnel intermediate shaft	
Secondary aquifers (superficial deposits and Mercia Mudstone Group)	Construction of the intermediate shaft will involve the construction of a diaphragm wall box structure from the surface down to a depth of around 60mbGL. Dewatering and internal shaft excavation works will occur once the diaphragm walls have been installed. During construction there is a minor risk of contaminant pathways being created from the surface to the underlying aquifers. However, the shaft would be pumped to keep it dry so any contaminants from the internal shaft workings would be removed with the dewatering discharge. Any groundwater needing to be removed from the shaft will be discharged appropriately. The shaft diaphragm walls will largely exclude groundwater in the superficial deposits, dewatering will therefore likely be limited to the Mercia Mudstone Group and of low volume as the permeability of the

Groundwater Receptors	Construction effects
	bedrock is low. The impact of dewatering is considered to be minor of a moderate value resource, and thus not significant.
River Tame	Impacts from temporary dewatering works are considered negligible based on the mitigation measures set out in the CoCP (concerning waste water and groundwater best practice measures) and therefore not significant
Bromford tunnel east portal	
Secondary aquifers (superficial deposits and Mercia Mudstone Group)	Impacts from temporary dewatering works are considered negligible based on the mitigation measures set out in the CoCP (concerning wastewater and groundwater best practice measures) and therefore not significant

Flood risk

18.4.8 The 2013 ES, as amended, concluded that the Phase One scheme would be resilient up to and including a 0.1% Annual Exceedance Probability (AEP) flood event. Bromford tunnel east portal of the Phase One scheme would be located outside of flood zone 3 (<0.1% AEP) and therefore at a low risk of flooding from fluvial sources. However due to the significant impacts that could be caused by flooding to the portal, flood management measures and defence structures were incorporated into the design. Provisions were made to enable surface water flows entering the tunnel to be captured and removed using a pumping system. This system would be designed to manage flows up to a 0.1% AEP event.

18.4.9 The Phase One scheme proposed to realign the River Tame. This would result in changes to flow patterns and the interaction with the existing floodplain, meaning that replacement flood storage would be required at Park Hall nature reserve. The Phase One scheme design would replicate and accommodate surface water flow patterns and thus not result in an increase in flood risk. The 2013 ES, as amended, identified no other significant temporary or permanent effects from the Phase One scheme.

Table 18.5.3 Impacts to flood risk arising from incorporation of Proposed Development

Receptors	Construction effects
Bromford Tunnel Extension	
Fluvial Flood Risk	The proposed tunnel extension would not be at risk of flooding as the route would be located below ground. Any discharges relating to pumping or removal of water would be negligible in the context of any flood event, resulting in an effect of neutral significance, which is not significant.
Surface Water Flood Risk	
Groundwater Flood Risk	

Receptors	Construction effects
Reservoir, canal and other sources	The main risk of flooding to the tunnel would be due to the ingress of flood water at either portal or the ventilation shaft identified separately, below.
Bromford Tunnel Intermediate Shaft	
Fluvial Flood Risk	Construction of the shaft will involve the construction of a box structure from the surface down to a depth of around 60mbGL. During construction there is a risk of flooding ingress from fluvial flooding of the River Tame and tributaries. Based on the latest EA flood map for planning the intermediate shaft is partially situated within flood zone 2 (Medium probability of flooding: between a 1% AEP and 0.1% AEP chance of occurrence in a given year). The latest hydraulic modelling provided by the EA as part of the Bromford and Castle Vale flood risk management scheme (Bromford FRMS) shows that the proposed asset in not located within the 0.1% AEP modelled extent. Impacts to flooding as a result of construction works would be negligible within the context of the wider River Tame catchment, resulting in an effect which is of neutral significance, which is not significant.
Pluvial Flood Risk	Flooding resulting in exceedance events (Proposed Development is designed to manage flows up to a 0.1% AEP flood event) is likely to be localised and therefore considered to be of a negligible impact, resulting in an effect of neutral significance, which is not significant .
Groundwater Flood Risk	The Proposed Development is located in an area shown to be a low productive aquifer with some moderate productivity in superficial deposits. There is a risk that groundwater flooding may present a risk when levels in the River Tame are high. However, based on the assessed impacts on fluvial flood risk (presented above) the impact of groundwater flooding is likely to be negligible, resulting in an effect of neutral significance, which is not significant.
Reservoir, canal and other sources	In the event of an uncontrolled breach the site of the Proposed Development may be at risk of flooding. The Proposed Development will not contribute to this flooding and the likelihood of an event of this nature occurring is very low. Therefore, the impact of this is negligible resulting in an effect of neutral significance, which is not significant.
Bromford Tunnel East Portal	
Fluvial Flood Risk	EA flood mapping indicates that the location of the east portal is shown to be outside of the 0.1% AEP flood extents and thus to deemed to be at a very low risk of fluvial flooding. Due to the impact of potential flooding to the tunnel via ingress at the eastern portal flood defences will be included in any design. Therefore, the impact to fluvial flooding as a result of the proposal is considered to be negligible, resulting in an effect of neutral significance, such that it will not have a significant adverse effect on fluvial flood risk.
Pluvial Flood Risk	Flooding resulting in exceedance events (Proposed Development is designed to manage flows up to a 0.1% AEP flood event) is likely to be localised and therefore considered to be of a negligible impact, resulting in a neutral effect which is not significant.
Groundwater Flood Risk	The Proposed Development is located in an area shown to be a low productive aquifer. There is a chance that groundwater flooding may present a risk when river levels are high. However, in this situation, groundwater flooding is unlikely to be of concern given the assessed impacts of fluvial flooding at this location. Groundwater flooding is

Receptors	Construction effects
	therefore likely to be of a negligible impact, resulting in a neutral effect, which is not significant.
Reservoir, canal and other sources	In the event of an uncontrolled breach the site is not shown to be at risk of flooding through inundation. The Proposed Development will not contribute to this type of flooding and therefore there is no associated impact or significance.

Other mitigation and residual effects

18.4.10 As no other mitigation measures are required, the likely significant effects remain as reported above.

Cumulative effects

18.4.11 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

18.5 Effects arising during operation

Avoidance and mitigation measures

18.5.1 The Proposed Development includes embedded measures to mitigate effects on water resource or flood risk receptors. In addition, ongoing design and construction of the Proposed Development will be undertaken in accordance with the EMRs, contained within the corresponding suite of documents that sit alongside the 2017 Act, with which HS2 Ltd must comply. These measures include:

- management of railway drainage using sustainable drainage techniques;
- discharges will be predominantly restricted with balancing ponds to emulate the existing environment by reducing run-off to greenfield rates;
- sustainable drainage mitigation will be provided to address risks to the receiving watercourses (for both flow and water quality) from road drainage;
- sustainable drainage will also reduce the risk of any potential contamination from accidental leaks or polluted surface water runoff from reaching the groundwater and, therefore, prevent deterioration in groundwater quality status.

Assessment of impacts and effects

Surface Water

18.5.2 The 2013 ES, as amended, identified one potentially significant permanent effect on the River Tame from the Phase One scheme which was related to track drainage affecting water quality. The impact would be mitigated by use of

balancing ponds. With regard to the Proposed Development, this effect is removed as track drainage would no longer be routed to the River Tame. Track drainage to any other watercourses would be attenuated using balancing ponds resulting in no significant effects.

Groundwater

18.5.3 The 2013 ES, as amended, did not identify significant temporary or permanent effects resulting from the Phase One scheme. Non-significant effects that were identified for the Phase One scheme and those effects arising as a result of the Proposed Development are set out in Table 18.6.1 and Table 18.6.2, respectively.

Table 18.6.1 Groundwater effects of the Phase One scheme

Groundwater Receptors	Operational effects
Secondary aquifers (superficial deposits and Mercia Mudstone Group)	Permanent blockage of groundwater flow in the superficial deposits by the Bromford Tunnel East Portal and Castle Bromwich retained cut which would fully penetrate the superficial deposits, preventing groundwater from moving along it's natural flow path. Additional mitigation measures were identified to be included in the design such as the installation of drains to allow flow to bypass the Bromford Tunnel East Portal and Castle Bromwich retained cut, and the provision of groundwater control by pumping when levels were high to overcome the impact such that the residual effect was not significant.

Table 18.6.2 Groundwater effects arising from incorporation of the Proposed Development

Groundwater Receptors	Operational effects
Bromford Tunnel Extension	
Secondary aquifers (superficial deposits and Mercia Mudstone Group)	The proposed tunnel extension would be located entirely within the Sidmouth Formation of the Mercia Mudstone Group until reaching the surface at the Bromford Tunnel East Portal, near Water Orton. This formation has poor permeability which will reduce the quantity of groundwater flow. The tunnel bore will remove some of the volume of aquifer and leave a very low permeability (effectively a barrier) feature, which will have a minor impact on groundwater flow in the area. Groundwater flow would still be able to move past the tunnel either above or below – depending on localised groundwater pressure gradients in the area. As the formation is a moderate value receptor with a minor impact the effect is minor adverse and not significant
Bromford Tunnel Intermediate Shaft	
Secondary aquifers (superficial deposits and Mercia Mudstone Group)	The completed intermediate shaft structure would create a blockage to flow in the superficial deposits and in the underlying bedrock. Given the groundwater is over 3m below the surface and superficial deposits are reasonably permeable it is assessed that blockage over a width of less than 50m will not cause a significant risk to groundwater flooding and the groundwater would thus flow around the structure. Groundwater in the bedrock, of low permeability, would also be able to accommodate the intrusion and would flow around this structure. The effect on groundwater flow during operation is thus considered negligible on moderate value resources, and thus not significant.

Groundwater Receptors	Operational effects
River Tame	Once operational it is considered that any groundwater within the superficial deposits and Mercia Mudstone will flow around the structure and feed into the river. As the river is a high value receptor with a negligible impact the effect is negligible and not significant
Bromford Tunnel East Portal	
Secondary aquifers (superficial deposits and Mercia Mudstone Group)	The tunnel portal foundations will likely sit at a depth of 62mAOD (i.e. about 23 to 26m below groundwater levels in the area of the east portal). The portal structure is likely to create a blockage to groundwater flow in both the Sidmouth Formation and the superficial deposits across the alignment, potentially leading to groundwater ponding upgradient (west) of the portal which could even rise up to ground level creating a groundwater flooding risk. To manage this groundwater flooding risk, the design for the east portal would include appropriate drainage features that intercepted groundwater at the upgradient side of the portal and then direct this flow past the northern end of the portal to discharge within the superficial deposits on the eastern side of the structure. The drainage will be designed to ensure that flow rates for groundwater would be sufficient to avoid any pooling of groundwater on the upgradient (western) side of the portal. This would produce a negligible impact on the moderate value superficial aquifers, as a result the effect is not significant. This would also reduce the risk of groundwater flooding with the effect being not significant.

Flood risk

18.5.4 A summary and discussion of the effects on flood risk as a result of the Proposed Development is outlined below.

Table 18.6.3 Effects to flood risk arising from incorporation of the Proposed Development

Receptors	Operational effects
Bromford Tunnel Extension	
Fluvial Flood Risk	The proposed tunnel extension would not be at risk of flooding as the route would be located below ground. Any discharges relating to pumping or removal of water would be negligible in the context of any flood event, resulting in an effect of neutral significance, which is not significant. The main risk of flooding to the tunnel would be due to the ingress of flood water at either portal or the ventilation shaft identified separately.
Surface Water Flood Risk	
Groundwater Flood Risk	
Reservoir, canal and other sources	
Bromford Tunnel Intermediate Shaft	

Receptors	Operational effects
Fluvial Flood Risk	Based on the latest EA flood map for planning the proposed location is partially situated within flood zone 2 (Medium probability of flooding: between a 1% AEP and 0.1% AEP chance of occurrence). The latest hydraulic modelling provided by the EA as part of the Bromford and Castle Vale flood risk management scheme (Bromford FRMS) commission shows that the proposed asset in not located within the 0.1% AEP modelled extent. Any changes to flood risk shown to occur locally would be negligible within the wider context of fluvial flood risk in the River Tame. Any impacts would be negligible, resulting in an effect of neutral significance, which is not significant.
Pluvial Flood Risk	The completed shaft and surrounding assets would result in an increase in impermeable surfaces. Given the location of the works within an already heavily urbanised environment, and the fact that, in accordance with the EMR (Annex 4: Environmental Memorandum), HS2 Ltd. is committed to avoiding material interference with existing hydrological patterns through reasonably practicable measures, any changes or increase in pluvial flood risk are deemed to be negligible in impact, resulting in an effect of neutral significance, which is not significant.
Groundwater Flood Risk	The Proposed Development is located in an area shown to be a low productive aquifer with some moderate productivity in superficial deposits. There is a risk that groundwater flooding may present a risk when levels in the River Tame are high. However, based on the assessed impacts on fluvial flood risk (presented above) the impact of groundwater flooding is likely to be negligible, resulting in an effect of neutral significance, which is not significant
Reservoir, canal and other sources	In the event of an uncontrolled breach the Site may be at risk of flooding. The Proposed Development will not contribute to this flooding and the likelihood of an event of this nature occurring is very low. Therefore, the impact of this is negligible, resulting in an effect of neutral significance, which is not significant.
Bromford Tunnel East Portal	
Fluvial Flood Risk	EA flood mapping indicates that the location of the east portal is shown to be outside of the 0.1% AEP flood extents and thus to deemed to be at a very low risk of fluvial flooding. Due to the impact of potential flooding to the tunnel via ingress at the eastern portal flood defences will be included in any design. Therefore the impact to fluvial flooding as a result of the Proposed Development is considered to be negligible, resulting in an effect of neutral significance, which is not significant.
Pluvial Flood Risk	The proposed location of the east portal will require flood defences to prevent the ingress of flooding into the tunnel. These defences, consisting of flood defences surrounding the portal may result in changes to pluvial flow paths. An existing flow path is shown to flow via an underpass on the M6, adjected to the A452 – Lanchester Way Junction. The tunnel portal would be located within medium to low risk pluvial flood extents. Without appropriate mitigation this may result in: Increase in flooding on the A452 caused by the backing up of flows through an existing underpass Changes to pluvial flood risk for properties on Plank Lane and Attleboro Lane located approximately 500m to the north east of the portal Any changes to flood risk would be appropriately mitigated through well-established and reasonably practicable measures integral to the Proposed Development. Overall,

Receptors	Operational effects
	the impact would be negligible, resulting in an effect of neutral significance, which is not significant.
Groundwater Flood Risk	The Proposed Development is located in an area shown to be a low productive aquifer. There is a chance that groundwater flooding may present a risk when river levels are high. However, in this situation, groundwater flooding is unlikely to be of concern given the assessed impacts of fluvial flooding at this location. Groundwater flooding is therefore likely to be of a negligible impact, resulting in an effect of neutral significance, which is not significant.
Reservoir, canal and other sources	In the event of an uncontrolled breach the site is not shown to be at risk of flooding through inundation. The Proposed Development will not contribute to this type of flooding and therefore there is no associated impact or significance.

Other mitigation and residual effects

18.5.5 No other mitigation measures are considered appropriate. The likely residual significant effects are captured and reported above.

Cumulative effects

18.5.6 No cumulative effects have been identified as a result of the Proposed Development and committed developments. As a result, no new or different adverse significant cumulative effects would result from the Proposed Development, as compared with the Phase One scheme.

18.6 Summary

18.6.1 No new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme.

18.6.2 No significant residual effects on surface water or groundwater resources were identified for the Phase One scheme, as all effects would be mitigated by standard design or construction practices. No new or different significant adverse effects are expected to arise in relation to the Proposed Development. Overall, construction effects on surface water receptors resulting from the Proposed Development would be reduced compared to the Phase One scheme, as there would be much less direct disturbance to watercourses. Fluvial flood risks would be reduced as a result of the Proposed Development because some embankment works and diversion of the River Tame would no longer be required. Minor pluvial flood risks arising due to new infrastructure, at the proposed intermediate shaft and Bromford Tunnel East Portal, would be mitigated through well-established and reasonably practicable measures integral to the Proposed Development, as appropriate and consistent with the approach for the Phase One scheme.

Surface water

18.6.3 No significant residual effects on surface water resources were identified for the Phase One scheme, as all effects were mitigated by standard design or construction practices, and no significant effects on surface water resources are expected to arise in relation to the Proposed Development.

18.6.4 Overall construction effects on surface water receptors resulting from the Proposed Development would be reduced compared to the Phase One scheme, as there would be much less direct disturbance to watercourses.

18.6.5 Permanent beneficial WFD effects as a result of the Phase One scheme were anticipated in relation to the realignment of Plants Brook and the River Tame; these would no longer be realised as part of the Proposed Development.

Groundwater

18.6.6 No significant residual effects on groundwater resources were identified in relation to the Phase One scheme. This remains the case in relation to the Proposed Development, including in relation to the corresponding tunnel extension, portal and intermediate shaft.

Flood risk

18.6.7 No significant effects would arise as a result of the Proposed Development. Fluvial flood risk would be improved as a result of the Proposed Development, as compared with the Phase One scheme, because the Phase One scheme embankment works and diversion of the River Tame would no longer be required. Based on the latest EA modelling information for the 0.1% AEP flood event replacement flood storage works would not be required for the Proposed Development. Minor impacts to pluvial flooding due to the Bromford Tunnel East Portal, potentially increasing flood risk to the A452, would be mitigated by well-established and reasonably practicable measures as part of the Proposed Development. Whilst the intermediate shaft and surrounding assets, as part of the Proposed Development, may result in an increase in impermeable surfaces, the Proposed Development is located within an already heavily urbanised environment and changes or increase in flood risk would not be considered significant in the context of wider pluvial flood risk.

19 Conclusion

19.1 Summary of effects

19.1.1 This screening report compares the Phase One scheme assessed in the 2013 ES, as amended, with the Proposed Development, comprising new proposals for Bromford Tunnel Extension and ancillary works. The report, taking into account new baseline information, determines whether the Proposed Development is likely to have any new or different significant adverse effects on the environment, by virtue of factors such as its nature, size or location, for the purposes of the EIA Regulations.

19.1.2 With regard to agriculture, forestry and soils, in comparison to the Phase One scheme there would be a decrease in the area of best and most versatile land affected, together with reduced effects on both soil resources and on agricultural land holdings as a result of the Proposed Development. This is most notable for land holdings at Twisted Oak Stables and Park Hall nature reserve where, following site restoration of temporary construction sites, more land would be returned to agricultural use compared to the Phase One scheme. The Proposed Development would still require the total CFA25/2 (Land north of B4118 Birmingham Road) holding area during construction, however, it removes the requirement for any permanent ecological mitigation features in this area. Although there would be no reduction in the area of soil resources required for construction at Newlands Farm, the Proposed Development would only impact its most western land parcel (west of Attleboro Lane), which constitutes 3ha of the 93.1ha total land holding area. There would be no change to the area of land required within this holding and given that the effects of the Proposed Development would be restricted to this land parcel, any impacts would not alter the effects reported within the 2013 ES, as amended, for the entire holding.

19.1.3 A review of the existing air quality baseline showed that at relevant representative receptors affected by the Proposed Development, air quality would be considered to meet the relevant air quality standards. Effects from proposed construction activities would be controlled and managed through route-wide implementation of the HS2 Code of Construction Practice (CoCP) and therefore can be considered negligible and not significant. Air quality effects arising from changes to traffic associated with the construction of the Proposed Development were anticipated to be not significant. Pollutant concentrations would be well below the relevant air quality standards at all relevant representative human health receptors and the impact would be negligible and not significant. At the three ancient woodland sites in the vicinity of the Proposed Development, the change in concentration of nitrogen oxides both without and with the Proposed Development would be imperceptible and

therefore would be negligible and not significant. Operationally there were likely to be no new or different adverse significant effects resulting from the Proposed Development, compared with the Phase One scheme.

19.1.4 There would be a reduction in significant community effects as a result of the Proposed Development, compared with the Phase One scheme, as reported in the 2013 ES, as amended, because in-combination effects on the amenity of residents in some locations are no longer considered to be significant, due to reduced construction activity at Castle Bromwich Business Park. Additionally, the isolation effects on residents at Tameside Drive during construction are no longer considered to be significant, also due to reduced construction activity at Castle Bromwich Business Park.

19.1.5 The Proposed Development would reduce route wide carbon emissions by an estimated 20,500 tonnes (measured using the carbon dioxide equivalent), compared to the Phase One scheme. In terms of resilience to climate change, whilst there would be a risk to overheating within the tunnel this would be mitigated by the ventilation systems in the tunnel design. In addition, there is a likely benefit, compared with the Phase One scheme, due to the reduction in flood risk as a result of the Proposed Development.

19.1.6 In the case of cultural heritage, The Proposed Development would represent an improvement, compared with the Phase One scheme, in respect of cultural heritage. 26 heritage assets would no longer be affected and would remain undisturbed by the Proposed Development compared to the Phase One scheme. The impacts to a further 11 heritage assets would be reduced with these assets being only partially removed, whereas previously, in the case of the Phase One scheme, they would be fully removed.

19.1.7 The Proposed Development would avoid significant adverse effects in respect of habitats within and surrounding Park Hall Site of Importance for Nature Conservation (SINC), largely negating the significant effects which arose from habitat loss in this area as a result of the Phase One scheme. The works would, however, have an adverse effect on the Park Hall SINC, and habitats supported by the SINC, at a local/ parish level, during construction. By following the CoCP, there would be no significant effect on protected and notable species supported by the SINC. 0.7 ha of designated ancient woodland located within the SINC would be removed as a result of the Phase One Scheme and the remaining 2.3ha would be fragmented and are predicted to decline in value, such that their biodiversity interest would be effectively lost. These effects would be avoided as a result of the Proposed Development, with no direct or indirect effects on ancient woodland anticipated. Ecological receptors to be affected within the Proposed Development site outside Park Hall SINC are of limited value to ecology, with the exception of a medium population of great crested newts that

would be affected to the south of Water Orton (identified since the 2013 ES, as amended). The Proposed Development would result in an impact on this population at local/ parish level, and not considered significant. The 2013 ES, as amended, reported operational effects on populations of common pipistrelle bat, to be mitigated through additional woodland planting. No significant effects on ecological receptors, including common pipistrelle, would occur as a result of the Proposed Development during operation. The ecological effects of the Proposed Development, as described above, are of a much-reduced scale compared to those of the Phase One scheme. Once proposed habitat reinstatement has been undertaken there would be a few remaining ecological effects, resulting from the Proposed Development, which would be non-significant.

19.1.8 The health effects of the Proposed Development are, in most cases, similar to the effects reported for the Phase One scheme for the health determinants of access to green space, access to services, health and social care, recreation and physical activity and social capital. This screening assessment is more specific in its reporting on the neighbourhood quality health determinant; it identifies people in several communities are likely to experience features of the Proposed Development as changing the quality of their neighbourhood and to regard that change as adverse. The assessment of the Proposed Development is more specific than the Phase One Health Impact Assessment (HIA) report in identifying the locations of communities predicted to experience these effects, together with the nature, magnitude and sensitivity of the effects. However, the Proposed Development is not expected to result in new or different adverse health effects, including cumulative health effects, as compared with those reported in the Phase One HIA report.

19.1.9 With regards to land quality no new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme. The number of contaminated sites in Castle Bromwich Industrial Estate and Park Hall SINC affected by the Proposed Development would be reduced compared with the Phase One scheme. These sites would not benefit from remediation provided by the Phase One scheme and considering that remediation would not be required impacts relative to baseline are therefore likely to be negligible. The footprint of the intermediate shaft is not sufficient to require remediation of the full extent of the historical landfill; therefore, the beneficial effects of this remediation would only be minor and not significant for the adjacent properties. Disturbance of the historical landfill site underlying Castle Bromwich Industrial Estate would occur as a result of the Proposed Development, which would also be the case in respect of the Phase One scheme; this may result in the temporary generation and migration of ground gases. However, mitigation measures would be put in place to ensure there are no significant effects. Where remediation is carried out on contaminated sites

within the land required for construction of the Proposed Development, there would be residual land quality benefits associated with this remediation, as would be the case in respect of the Phase One scheme.

19.1.10 In terms of landscape and visual amenity, no new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme. The Proposed Development would result in alternative infrastructure, and construction thereof, near Water Orton, however with the corresponding mitigation in place (including appropriate landscape proposals) the significance of landscape and visual effects would be comparable with those reported in the 2013 ES, as amended. In the case of the Phase One scheme and the Proposed Development, although there would be significant effects during construction, during operation effects would diminish to not significant due to the establishment of landscape planting mitigation proposals. Between Water Orton and Castle Bromwich Business Park, the landscape and visual effects resulting from incorporation of the Proposed Development would generally be reduced, and in many cases removed, compared with the Phase One scheme (which included the River Tame viaduct in this area). This is because infrastructure would be primarily located underground, within the extended tunnel, such that it would not result in significant landscape and visual effects during operation and the Proposed Development would provide an improvement in these respects, compared with Phase One scheme. At Castle Bromwich Business Park, landscape and visual effects resulting from incorporation of the Proposed Development would be comparable with, or reduced, compared with the Phase One scheme; again, the Proposed Development would provide an improvement compared with the Phase One scheme.

19.1.11 Environmental risks in relation to major accidents and disasters would be managed in accordance with legal obligations and industry standards and would not result in significant environmental effects. The requirement to undertake an assessment of the environmental effects of major accidents and disasters has been introduced since the 2013 ES, and therefore was not included in the 2013 ES, but has been included as part of this screening report. The approach for this assessment includes consideration of risk events that are relevant to the Proposed Development, identifying whether those risk events constitute a major accident or disaster, defining the impact, and assessing the associated likelihood and risk. In accordance with the HS2 development agreement, the principle of reducing risks to a level that is as low as reasonably practicable (ALARP) would be applied, which is the approach accepted by the Office of Rail and Road. As a result, it is considered that that the Proposed Development would not result in significant environmental effects arising from the vulnerability of the Proposed Development to major accidents and disasters.

19.1.12 As in the case of the Phase One scheme, socio-economic effects during construction would be minimised through measures such as applying best practicable means (BPM) to reduce noise and vibration at sensitive locations (including local businesses) and site-specific traffic management measures to limit traffic-related disruption. As less land occupied by businesses would be required for the Proposed Development, compared with the Phase One scheme, socio-economic effects would be reduced. The positive socio-economic effects of the Proposed Development, arising from increased employment opportunities during construction and operation, would be comparable with those arising from the Phase One scheme.

19.1.13 The area around the Proposed Development is already affected by noise sources including the M6 and M42 motorways, overflying aircraft and other highways and main line railways. Noise receptors in the area include dwellings, industrial and commercial buildings. Additional sources of noise and vibration, as a result of the Phase One scheme and Proposed Development, include temporary sources during construction and permanent sources during operation of the railway. These may be further subdivided into direct effects from the noise and vibration sources themselves, such as the tunnel boring machine during construction and from trains on the operational railway, and indirect effects such as noise changes due to road traffic diversions. The 2013 ES, as amended, considered all of these additional sources of noise and vibration and in some cases significant adverse effects were expected to arise. Some different construction activities would occur as a result of the Proposed Development, as compared with the Phase One scheme, but none of these are expected to produce new or different significant adverse sound, noise and vibration effects. The Proposed Development would reduce operational airbone noise for a number of receptors, as compared with the Phase One scheme, due to the placing of exposed track in tunnel, in the vicinity of those receptors. Levels of operational ground-borne noise and vibration would not materially change as a result of the Proposed Development, compared with the Phase One scheme.

19.1.14 In relation to traffic and transport, no new or different significant adverse effects would result from the Proposed Development, as compared with the Phase One scheme. The Proposed Development would remove five construction compounds and associated lorry and other vehicle movements that were needed for the Phase One Scheme. In addition, tunnel operations would be driven from the east portal instead of the west portal, with the main access and egress for heavy goods vehicles to the east portal taken directly from the M6-M42 Link Road. The combined impact of these changes would not result in any new or different significant adverse effects, as compared with the Phase One scheme. The most intensive peak periods of construction in relation to the Proposed Development would result in localised increases in traffic, however such increases would not be significant and would not result in new or different

significant adverse effects compared with the Phase One Scheme. Operationally, the Proposed Development would provide the same increased capacity on train services and substantial reductions in journey times between Birmingham and London as reported in the 2013 ES, as amended. This would result in beneficial transport effects, as is consistent with the Phase One scheme.

19.1.15 The Proposed Development would not result in any waste and material resources effects that are greater than those reported in relation to the Phase One scheme, such that no new or different significant adverse effects would arise as a result of the Proposed Development. The key difference between the Proposed Development and the Phase One scheme is that the extension of the tunnel would result in an increase of excavated material quantities. However, these excavated materials would be diverted from off-site disposal, as proposed in the case of the Phase One scheme, and reused on-site for environmental mitigation earthworks purposes, where appropriate and suitable, in the case of the Proposed Development. Compared with the Phase One scheme, there would be an increase in hazardous material requiring off-site disposal for the Proposed Development, due to excavation for the Bromford tunnel intermediate shaft within a former landfill site, however the quantity of material would not result in a new of different significant effect compared to the Phase One scheme as excavation for the Phase One scheme east tunnel portal would occur within the same former landfill site. The Proposed Development would result in a decrease in material arising from demolition, in turn reducing the requirement for off-site disposal of demolition waste to landfill.

19.1.16 No significant residual effects on surface water or groundwater resources were identified for the Phase One scheme, as all effects would be mitigated by standard design or construction practices. No new or different significant adverse effects are expected to arise in relation to the Proposed Development. Overall, construction effects on surface water receptors resulting from the Proposed Development would be reduced compared to the Phase One scheme, as there would be much less direct disturbance to watercourses. Fluvial flood risks would be reduced as a result of the Proposed Development because some embankment works and diversion of the River Tame would no longer be required. Minor pluvial flood risks arising due to new infrastructure, at the proposed intermediate shaft and Bromford Tunnel East Portal, would be mitigated through well-established and reasonably practicable measures integral to the Proposed Development, as appropriate and consistent with the approach for the Phase One scheme.

19.1.17 In conclusion, this report finds that, following mitigation, there are no new or different significant adverse effects caused by the Proposed Development, as compared with the Phase One scheme, such that it should not be considered the subject of additional and separate environmental impact assessment. In

addition, relative benefits are reported, primarily due to placing of the railway in tunnel and the corresponding reduced influence of development proposals on areas of land, and associated environmental receptors, between Water Orton and the eastern edge of Birmingham.

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