The High Speed Rail (London – West Midlands) (Greatmoor Railway Sidings Etc.) Order

Environmental Statement
Volume 2:
Main Environmental Statement

August 2016
CS573_5.2

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Department for Transport

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

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

Telephone: 020 7944 4908

General email enquiries: HS2enquiries@hs2.org.uk

Website: www.gov.uk/hs2

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

ATKINS ERM Mott MacDonald TEMPLE

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Glossary

AADT	annual average daily traffic
ALC	Agricultural Land Classification
AOD	Above Ordnance Datum
AP	Additional Provision
APIS	UK Air Pollution Information System
AQMA	Air Quality Management Area
AVDC	Aylesbury Vale District Council
ATC	Automatic Traffic Count
BAP	Biodiversity Action Plan
BBOWT	Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust
BCC	Buckinghamshire County Council
BGS	British Geological Survey
BMV agricultural land	best and most versatile agricultural land
BNS	Biological Notification Site
BPM	Best Practicable Means
CIEEM	Chartered Institute of Ecology and Environmental Management
CoCP	Code of Construction Practice
CoPA	Control of Pollution Act
CSM	Conceptual Site Model
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EfW	Energy from Waste
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
ES	Environmental Statement
ETM	ERM, Temple, Mott MacDonald
EU	European Union
EWR2	East West Rail Phase 2
FCC	FCC Waste Services (UK) Ltd.
FCD	Field Capacity Day
GLVIA	Guidelines for Landscape and Visual Impact Assessment
HGV	Heavy Goods Vehicles
HS2	High Speed Two (London-West Midlands)
IAQM	Institute of Air Quality Management
IEEM	Guidelines for Ecological Impact Assessment
IPC	Integrated Pollution Control
IPPC	Integrated Pollution Prevention and Control
IRZ	Impact Risk Zones
LCA	landscape character area
LGS	Local Geological Sites
LOAEL	Lowest Observable Adverse Effect Level
LWS	Local Wildlife Site
MCC	Manual Classified Count
NERC	Natural Environment and Rural Communities
NO_2	Nitrogen dioxide

NPPF	National Planning Policy Framework
NTS	Non-Technical Summary
OS	Ordnance Survey
PRoW	Public Right of Way
PPG	Planning Policy Guidance
PWS	Public Water Supply
SES	Supplementary Environmental Statement
SMR	Scoping and Methodology Report
SOAEL	significant observed adverse effect level
SPZ	Source Protection Zone
SSSI	Site of Special Scientific Interest
SuDS	sustainable drainage systems
Thames RBD	Thames River Basin District
Thames RBMP	Thames River Basin Management Plan
TEMPRO	Trip End Model Presentation Program
TIN	Technical Information Note
TWAO	Transport and Works Act Order
uFMfSW	updated Flood Map for Surface Water
WC	Wetness Class
WFD	Water Framework Directive
ZTV	Zone of Theoretical Visibility

1 Introduction

1.1 Overview

1.1.1 FCC Waste Services (UK) Ltd. (FCC) operates the Calvert landfill site and Greatmoor Energy from Waste (EfW) facility, which are located to the south of the village of Calvert, west of the Aylesbury Link railway line and the proposed Phase One alignment of High Speed Two (HS2) (London-West Midlands). As part of its current operation, FCC brings in material to the Calvert landfill and Greatmoor EfW facility by rail which is off loaded at existing railway sidings currently located at Calvert on the west side of the Aylesbury Link railway line. Relocation of the sidings to the east of the Aylesbury Link railway line is required to accommodate the proposed HS2 Phase One alignment.

1.1.2 The HS2 Phase One Environmental Statement[1] (HS2 Phase One ES) included the relocation of the sidings to a location on the east side of the Aylesbury Link railway line and the proposed HS2 alignment, to the north of Decoypond Wood. The layout of the sidings was subsequently modified as part of Supplementary Environmental Statement (SES) 3 and Additional Provision (AP) 4 (which was deposited in October 2015)[2], to more closely replicate the existing FCC railway sidings layout and track length.

1.1.3 FCC, Buckinghamshire County Council (BCC), Aylesbury Vale District Council (AVDC), Calvert Green Parish Council, Charndon Parish Council and local residents petitioned the HS2 Ltd. Phase One hybrid Bill in the House of Commons. They requested the relocation of the sidings approximately 1.8km south of Calvert south of Sheephouse Wood at Greatmoor, Buckinghamshire, opposite the Greatmoor EfW facility. The House of Commons Select Committee recognised benefits for local residents in distancing the sidings from the village and indicated a preference for an option south of Sheephouse Wood in the Second Special Report of Session 2015-16.

1.1.4 As such, HS2 Ltd has worked with FCC in developing a scheme at Greatmoor, which forms the basis of this ES.

1.1.5 HS2 Ltd is promoting an application for a Transport and Works Act Order (TWAO) to construct the replacement sidings which are referred to in this ES as the Proposed Scheme. If the TWAO is confirmed by the Secretary of State for Transport, this will result in the removal of the provisions contained within the HS2 Phase One hybrid Bill which sought to authorise the sidings to the east of the Aylesbury Link railway. In doing so, HS2 Ltd recognises the benefits of the TWAO scheme over the original scheme in addressing the petitioners' concerns. HS2 Ltd considers that the proposed TWAO will deliver the outcome requested by the Select Committee, addressing the petitioners' concerns.

[1] HS2 Phase One Environmental Statement available online at https://www.gov.uk/government/collections/hs2-phase-one-environmental-statement-documents

[2] HS2 Phase One SES3 and AP4 available online at https://www.gov.uk/government/collections/supplementary-environmental-statement-3-and-additional-provision-4-supplementary-environmental-information

1.1.6 The likely significant environmental effects of the Proposed Scheme have been assessed in this Environmental Statement (ES) as part of the Environmental Impact Assessment (EIA) process. The ES has been undertaken in accordance with the requirements of Rules 7 and 10 of the Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006 (the TWAO Rules) (Ref. 1-7). The results of the EIA are presented within this ES.

1.1.7 In addition to the TWAO Rules, the ES has also taken account of the requirements of the Town and Country Planning EIA (England and Wales) Regulations 2011 ("the EIA Regulations").

1.1.8 This ES consists of four volumes as follows:

- Volume 1: Non-Technical Summary;
- Volume 2: Main Environmental Statement;
- Volume 3: Environmental Statement Maps; and
- Volume 4: Environmental Statement Technical Appendices; consisting of:
  - Volume 4.01: Environmental Statement Technical Appendix: Additional information;
  - Volume 4.02: Environmental Statement Technical Appendix: Agriculture, forestry and soils impact assessment;
  - Volume 4.03: Environmental Statement Technical Appendix: Air quality impact assessment;
  - Volume 4.04: Environmental Statement Technical Appendix: Cultural heritage baseline report;
  - Volume 4.05: Environmental Statement Technical Appendix: Gazetteer of heritage assets;
  - Volume 4.06: Environmental Statement Technical Appendix: Cultural heritage impact assessment;
  - Volume 4.07: Environmental Statement Technical Appendix: Cultural heritage remote sensing survey summary;
  - Volume 4.08: Environmental Statement Technical Appendix: Ecology baseline data, survey results and non-significant effects;
  - Volume 4.09: Environmental Statement Technical Appendix: Land quality impact assessment;
  - Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment;
  - Volume 4.11: Environmental Statement Technical Appendix: Transport Assessment;
  - Volume 4.12: Environmental Statement Technical Appendix: Water resources assessment;

- Volume 4.13: Environmental Statement Technical Appendix: Flood Risk Assessment; and
- Volume 4.14: Environmental Statement Technical Appendix: Draft Code of Construction practice.

1.1.9 This document is the Volume 2: Main Environmental Statement. It identifies and assesses the likely significant environmental effects that may result from the Proposed Scheme, proposes appropriate mitigation measures to address adverse effects, and identifies the anticipated potential significant residual effects.

The Proposed Scheme

1.1.10 The application site comprises an area of approximately 36.2ha as shown in Figure 1.

1.1.11 The Proposed Scheme comprises :

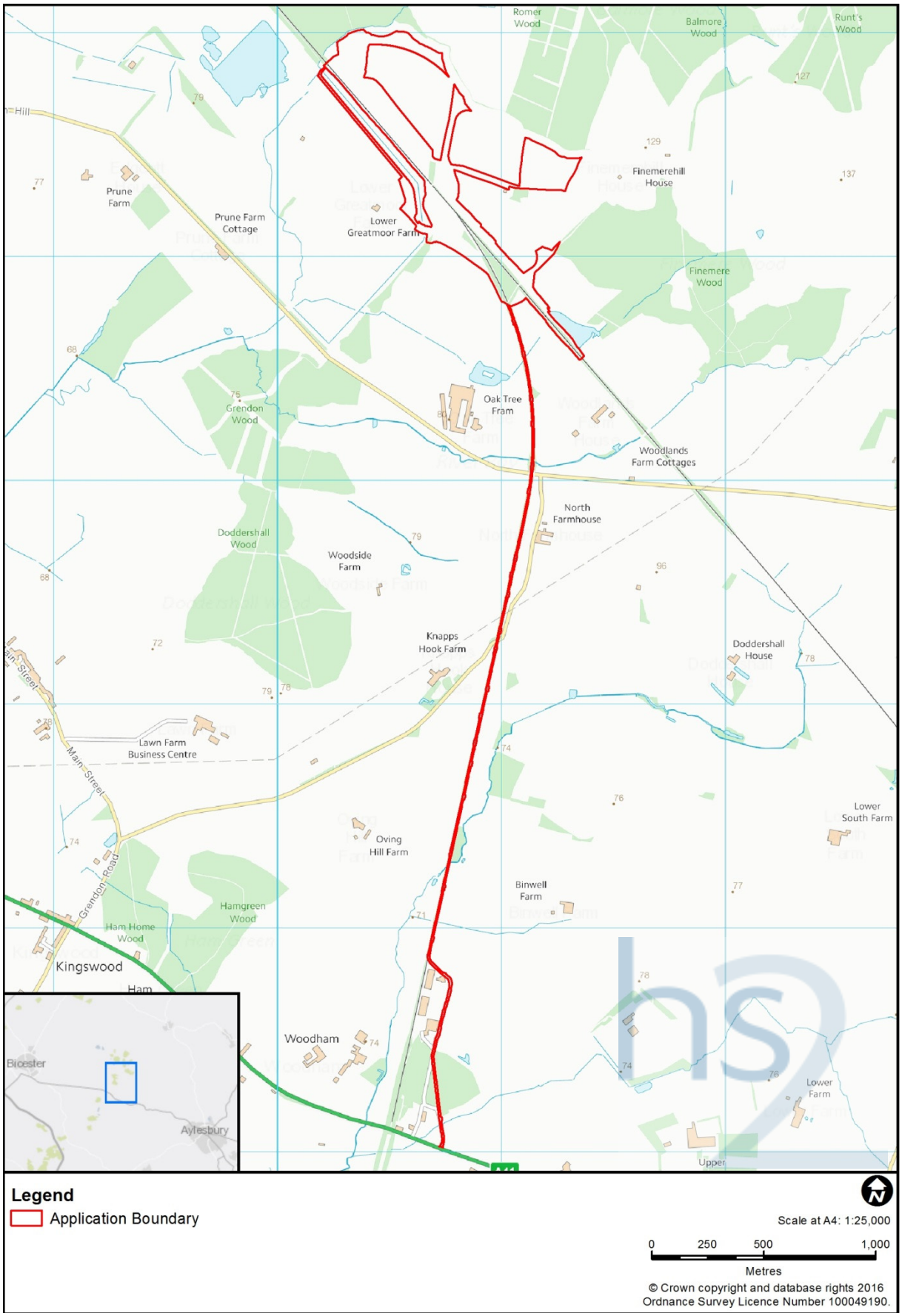
1. reception sidings - which will be used to hold arriving trains and departing trains;
2. operational sidings - which will be used to load and unload the trains and includes a rail mounted gantry crane and a roadway around the sidings to allow vehicle access and storage and management of the sidings;
3. office and welfare facilities;
4. Bridleway GUN/28 accommodation green overbridge;
5. Bridleway QUA/36 accommodation green overbridge;
6. an access road between the operational sidings and Greatmoor Road (previously the Akeman Street Disused Railway), which will provide limited maintenance access to the Proposed Scheme during operation;
7. a weighbridge;
8. vegetation management zones - areas where tall planting is removed to reduce bat activity;
9. environmental mitigation barriers - used to reduce disturbance from noise and light on the surrounding environment; and
10. other mitigation works including earthworks, drainage, planting and power connections.

1.1.12 The Station Road overbridge satellite compound will manage the civil engineering works for the Proposed Scheme. This compound will be established for the construction of HS2 Phase One, under powers which will be conferred by the hybrid Bill and not this TWAO. It is located approximately 3.5km south east of land required for the Proposed Scheme. The compound will be accessed via the M40, A41 and Station Road, Quainton from the west and via the M1, A4146, A418, A41 and Station Road, Quainton from the east.

1.1.13 The Greatmoor Railway Sidings Rail Systems satellite compound will be included within the Proposed Scheme site and will be accessed via Greatmoor Road. This satellite compound will be managed from the Calvert railhead main compound which

will be established for the construction of HS2 Phase One under powers which will be conferred by the hybrid Bill and not this TWAO.

Figure 1: Application boundary



1.2 Scoping report

1.2.1 A scoping report for the Proposed Scheme was submitted to the Secretary of State for Transport on 16th May 2016 as part of a request for a Scoping Opinion.

1.2.2 Table 1 provides a summary of the outcome of the scoping report, detailing which topics were scoped in or out.

Table 1: Summary of the outcome of the scoping report

Topic	Construction	Operation
Agriculture, forestry and soils	In	Out
Air quality	In	In
Climatic factors	Out	Out
Community	In	Out
Cultural heritage	In	In
Ecology	In	In
Equalities	Out	Out
Health	Out	Out
Land quality	In	In
Landscape and visual assessment	In	In
Socio economics	Out	Out
Sound noise and vibration	In	In
Traffic and transport	In	Out
Waste and material resources	Out	Out
Water resources and flood risk assessment	In	In

Scope refinements following formal opinion

1.2.3 Since submission of the scoping report there have been the following changes to the details of the application following comments received during pre-application meetings and further scheme development:

- the area of the application site has increased from approximately 32.9ha to 36.2ha; and
- the application now includes access along Greatmoor Road for new utility

supplies (currently used as the access road to the Greatmoor EfW facility).

1.3 Scoping opinion

1.3.1 A Scoping Opinion was received from the TWA Unit of the Department for Transport on 29th June 2016. The full Scoping Opinion letter is included in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

1.3.2 Scoping opinions were received from the below consultees:

- Department for Transport;
- BCC;
- AVDC;
- Environment Agency (EA);
- Historic England; and
- Natural England.

1.3.3 A full response to the Scoping Opinion is included in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

1.3.4 Table 2 details the responses to the Department for Transport Scoping Opinion.

Table 2: Scoping opinion from Department for Transport and response

Summary of Request/ Issue	Response
Ecology/FRA In relation to protected sites, and having regard to Natural England's Impact Risk Zones, the EIA should additionally consider the potential for effects from the proposed development on the following SSSI's: - Grendon and Doddershall Woods SSSI; - Ham Home-cum-Hamgreen Woods SSSI; and - Long Herdon Meadow SSSI, in view of the hydrological connectivity between the Muxwell Brook adjacent to the development site and the River Ray which runs into this SSSI.	Potential ecological effects of the Proposed Scheme on the following SSSI's have been considered in Volume 2: the Main ES, Section 9, Ecology: - Sheephouse Wood SSSI; - Finemere Wood SSSI; - Grendon & Doddershall Woods SSSI; and - Ham Home-cum-Woods SSSI. The effect on the following potentially water dependent ecological sites have been considered in Volume 2: the Main ES, Section 14, Water resources and flood risk: - Finemere Wood SSSI - Grendon and Doddershall Woods SSSI - Sheephouse Wood SSSI - Grendon and Doddershall Meadows LWS Long Herdon Meadow is not currently included in the ES. It is downstream of the Proposed Scheme and its botanical/bird interest is to some extent dependent on winter flooding. Adverse effects due to hydrological connectivity such as pollution can be assumed to be avoided through the implementation of the draft CoCP, it is assumed that pollution during operation would be controlled through FCC's environmental management systems.
Ecology In relation to protected species, the EIA should also consider the potential effects of vibration during construction of the development and the killing or injury of any species which are present during the construction period.	Potential vibration effects on ecological receptors during construction has been considered in Volume 2: the Main ES, Section 9, Ecology and Section 12, Sound , noise and vibration. Potential effects of increased human activity during construction and operation on ecological receptors has been considered in

The impacts of increased human activity during both construction and operation should also be considered.	Volume 2: the Main ES, Section 9, Ecology.
Landscape and visual In relation to the impact of lighting, the ES should include an assessment of the night-time impacts of the proposed development. The significance thresholds for this assessment should be discussed with the Landscape Officer of AVDC.	Potential effects of lighting on ecological receptors during operation has been considered in Volume 2: the Main ES, Section 9, Ecology. Potential effects of lighting on landscape and visual during operation has been considered in Volume 2: the Main ES, Section 11, Landscape and Visual. The AVDC landscape officer has been consulted regarding the Proposed Scheme. Thresholds were not discussed during consultation with AVDC landscape officer.
Traffic and transport public rights of way In relation to the impacts of the proposed development on public rights of way, the EIA should consider the issues raised by Buckinghamshire County Council indexed in Appendix B of its letter of 14 June commenting on the Scoping Report. The letter states: The Councils Public Rights of Way team have a number of concerns on the PRoW and supplied a plan detailing these concerns. PRoW comments - Appendix B 1) Definitive footpath is not accurately recorded; does it need diverting (see 7)? 2) Definitive footpath is not accurately recorded; 3) Definitive footpath is not accurately recorded 4) It would be useful to upgrade this route to bridleway in order to connect walkers and cyclists between the bridleway to the north and the 'footpath and cycleway' to the south; 5) In light of 4) this should be a bridge suitable for walkers and cyclists; 6) Alternative continuation of the footpath and cycleway is not shown, though the original is shown as deleted on the plan; and 7) Possible alternative route for footpath that seems to make sense on the map: definitive path probably reflects the (now changed) historical land use and boundaries; and this suggestion could be more attractive to the landowner.	Temporary and permanent effects of the Proposed Scheme on Traffic, including PRoW and non-motorised users have been considered in Volume 2: the Main ES, Section 13, Traffic and transport.
Traffic and transport For the purposes of assessing construction traffic impacts, the Transport Assessment should establish existing traffic conditions in accordance with National Planning Policy Guidance and in consultation with BCC.	Automatic Traffic Counters (ATC) data to determine existing baseline traffic flows has been derived from 2012 and 2015 traffic surveys, commissioned as part of the HS2 Phase One ES. The effects of construction traffic generated by the Proposed Scheme have been considered in Section 13, Traffic and transport and in Volume 4.10: Environmental Statement Technical Appendix: Transport Assessment.

Water Resources and Flood Risk Assessment The screening distance for identifying surface water and groundwater features that may be affected by the proposed development should take into account activities which may affect sites more than 1km from the development having regard to the nature of those sites for example as a result of water dependency, and taking into account Natural England's Impact Risk Zones.	This approach is consistent with the HS2 main ES for the hybrid Bill. Sites outside of the 1km area would be considered if an impact was identified in a surface water or groundwater body which could impact on downstream sites. In the case of the Greatmoor Railway Sidings Proposed Scheme no impacts have been identified to surface water or groundwater bodies and as such no other impacts are expected outside of the 1km study area.
Water Resources and Flood Risk Assessment The ES should explain the criteria used for deciding whether to undertake hydraulic modelling. In carrying out the assessment of the impacts of the proposed development on water resources and flood risk, the promoter should address the issues raised by BCC identified in Appendix A to its letter of 14 June 2016 commenting on the Scoping Report.	The approach is consistent with the HS2 Phase One ES. Targeted modelling in the HS2 Phase One ES was undertaken where there was potential for a significant effect on a sensitive receptor. The basis of modelling was undertaken on the presumption that modelling was not done unless specifically required. Replacement floodplain storage has already been provided for HS2 Phase One. This compensation can be refined if necessary to take into account the sidings. The following has been taken from the Greatmoor Railway Sidings ES: Replacement flood storage will be provided for any losses arising due to structures, built volume or ground raising within the modelled 1 in 100 years return period floodplain, including an appropriate allowance for climate change. Storage will be replaced by volume at the same level from which it was removed in 100mm increments as per standard Environment Agency methodology. Replacement storage in all cases will be provided prior to construction. No works will be undertaken within the flood zones of the Muxwell Brook. However, the Proposed Scheme sidings fall within the area proposed for replacement flood storage for the proposed HS2 Phase One scheme. Consequently, the proposed HS2 Phase One mitigation will be modified to ensure sufficient mitigation is provided.

1.4 Environmental Impact Assessment / Purpose of this report

1.4.1 The purpose of an EIA is to identify the likely significant effects of a development on the environment. In simple terms, it does this by identifying the current (baseline) conditions, anticipating how these may change in the future, and predicting the potential impacts of the development across a range of topics.

1.4.2 Consultation with the local authorities and statutory and non-statutory bodies has been an ongoing process throughout design development.

1.4.3 The purpose of this ES is to identify the likely significant environmental effects of the construction and operation of the Proposed Scheme, propose mitigation measures to address any significant adverse effects, and identify any unmitigated significant residual environmental effects. Further information on the EIA approach for this ES is provided in Section 4.

1.5 Structure of the ES

The following sets out the structure of this document, Volume 2: Main Environmental Statement:

- Introduction
- Section 2, The Proposed Scheme;
- Section 3, Consideration of alternatives and options;
- Section 4, EIA methodology;
- Section 5, Agriculture, forestry and soils;
- Section 6, Air quality;
- Section 7, Community;
- Section 8, Cultural heritage;
- Section 9, Ecology;
- Section 10, Land quality;
- Section 11, Landscape and visual;
- Section 12, Sound, noise and vibration;
- Section 13, Traffic and transport;
- Section 14, Water resources and flood risk; and
- Section 15, Summary of likely residual significant effects.

1.6 The EIA team

1.6.1 This ES has been prepared and compiled by ERM, Temple, Mott MacDonald (ETM), Arup / AECOM and Atkins, on behalf of HS2 Ltd.

2 The Proposed Scheme

2.1 Site Description

2.1.1 The Proposed Scheme is located at Greatmoor, south of Calvert and Sheephouse Wood, at grid reference 470476, 222600, postcode HP18 0QN (refer to Figure 2).

2.1.2 The application site is for an area of approximately 36.2ha primarily comprised of agricultural land (currently used for grazing or arable crops) directly to the east of the Aylesbury Link railway line. The application site also includes the use of an access road along Greatmoor Road (previously known as the Akeman Street Disused Railway) which forms the access road to the Greatmoor EfW facility to the south.

2.1.3 Muxwell Brook runs to the north of the northern boundary of the Proposed Scheme. Other watercourses in the area include; the Mega Ditch (a deepened and widened diversion of the Muxwell Brook) which is located adjacent to parts of the Bridleway GUN/25, approximately 20m from the Proposed Scheme; and the River Ray, located to the south of the Proposed Scheme, which is culverted beneath Greatmoor Road.

2.1.4 According to the EA Flood Zone Map, the Proposed Scheme is located in Flood Zone 1, but adjacent to the flood zones of the Muxwell Brook (see Volume 4.13: Environmental Statement Technical Appendix: Flood Risk Assessment for further details).

2.1.5 The superficial geology beneath the area of the Proposed Scheme has been designated by the EA as a Secondary A aquifer.

2.1.6 Sheephouse Wood Site of Special Scientific Interest (SSSI) is located approximately 30m north of operational sidings of the Proposed Scheme. It is designated for its ancient woodland habitats and associated assemblages of birds, invertebrates and plants.

2.1.7 Finemere Wood SSSI is located approximately 170m east of the reception sidings and approximately 600m south east of the operational sidings of the Proposed Scheme. It is also designated as a SSSI for its ancient woodland, supporting rich communities of native plants, birds, insects and other animals.

2.1.8 A large area of semi-improved grassland, known as Finemere Wood nature reserve is located immediately adjacent (south east) of the Proposed Scheme. This area is owned and managed by Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust (BBOWT) but is not subject to formal designation as a Local Wildlife Sites (LWS). The western edge of the grassland is within the land required for the construction of the Proposed Scheme.

2.1.9 Greatsea and Romer Wood LWS is located approximately 30m north of the land required for the Proposed Scheme.

2.1.10 The Greatmoor EfW facility and the associated current and former landfills within the Calvert Landfill sites are located on the west side of the Aylesbury Link railway line, to the north west of the proposed sidings location.

2.1.11 Two residential dwellings lie adjacent to the Proposed Scheme; Lower Greatmoor Farm located approximately 90m to the west of the land required for the Proposed

Scheme and Finemerehill House, located approximately 140m to the east of the land required for the Proposed Scheme. Both these buildings are Grade II listed,

2.1.12 The following Public Rights of Way (PRoW) transect the sidings element of the Proposed Scheme:

- Public footpath CAG/2/1;
- Public footpath QUA/35/1;
- Public bridleway QUA/36/2;
- Public footpath GUN/31/1;
- Public Bridleway GUN/25/2;
- Public Bridleway GUN/28/1;
- Public bridleway GUN/25/1; and
- Public bridleway CAG/3/1.

2.2 Surrounding environment

2.2.1 The village of Calvert is located approximately 1.8km north of the Proposed Scheme.

2.2.2 Grendon and Doddershall Woods SSSI is located approximately 650m west of the land required for the construction of the Proposed Scheme.

2.2.3 Ham Home-cum-Hamgreen Woods SSSI[3] is located adjacent to the A41 Bicester Road and approximately 680m from land required for the construction of the Proposed Scheme.

2.2.4 The following LWS have been considered as part of this EIA:

- Grendon and Doddershall Meadows LWS 30m north of the land required for the Proposed Scheme;
- Grendon Underwood Meadows LWS approximately 1km south west ;
- Decoypond Wood LWS, approximately 1.2km north west;
- Calvert Railway Station LWS, approximately 2km north west; and
- Calvert Jubilee Nature Reserve approximately 2.2km north west.

2.2.5 The above woodlands, including Sheephouse Wood and Finemere Wood, are ancient woodlands and form remnant blocks of the medieval former royal hunting forest of Bernwood Forest. The term 'forest' in this sense does not necessarily mean woodland or trees and the extent may have been much wider than the physical extent of the woodland. The word may have originally been derived as a description of a place outside the ordinary law, and subject to special laws concerned with preserving game, specifically deer. This area of ancient woodlands and intervening farmed landscape

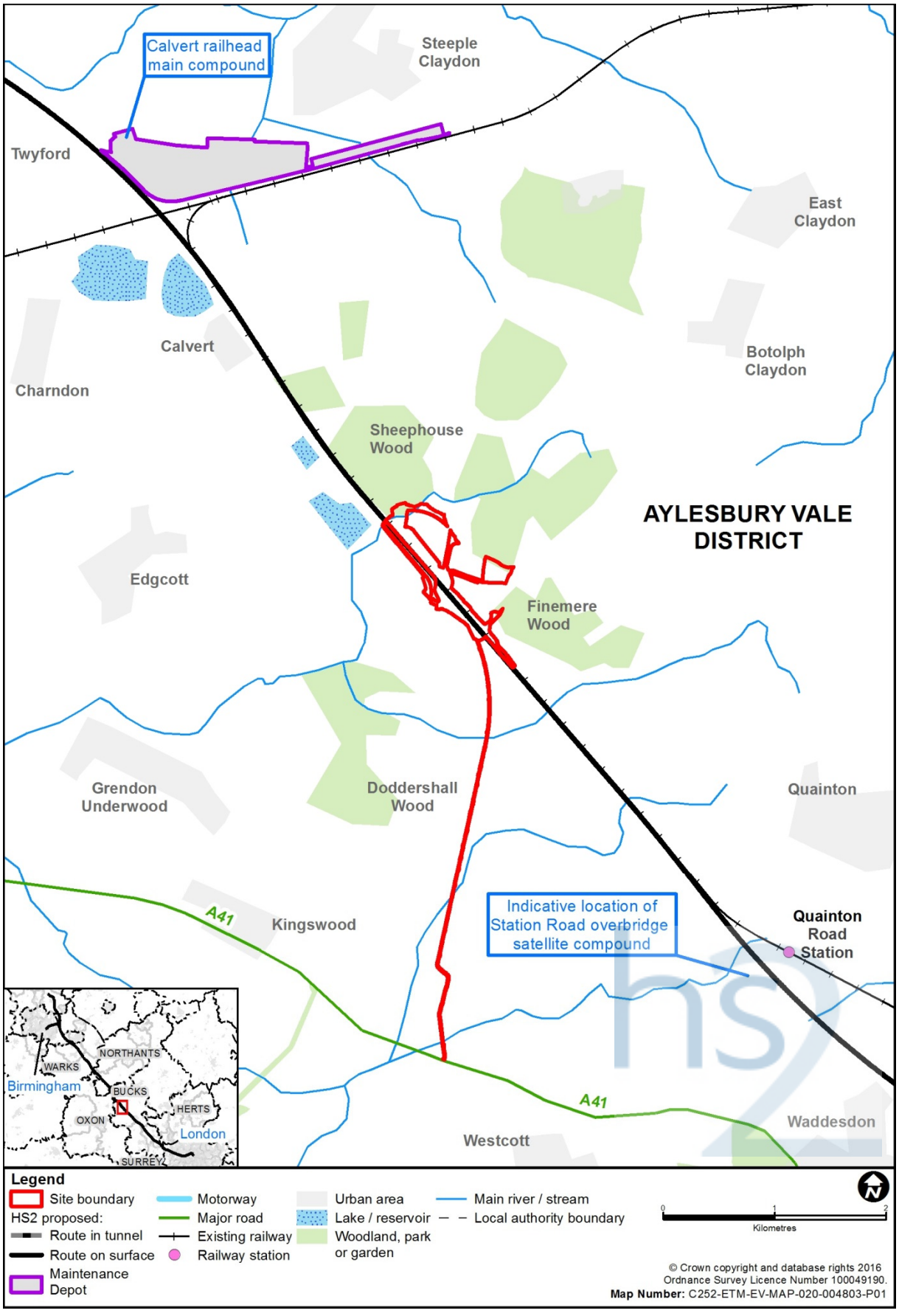
[3] http://www.sssi.naturalengland.org.uk/citation/citation_photo/1001358.pdf

has been identified as supporting an important assemblage of bat species each of varying rarity and importance ranging from common and widespread species to one of the rarest bat species in the UK. The population of Bechstein's bat in Bernwood Forest is one of the largest known populations in the UK. It is one of the rarest bats in the UK on the north western edge of its known distribution in Europe.

2.2.6 Many of the villages in the area have historic connections with Bernwood Forest such as Brill, where Edward the Confessor's hunting lodge was located, and Grendon Underwood which was formerly known as Grendon under Bernwode. There are many country houses in the area such as Whatton House and Claydon House. Calvert Jubilee Nature Reserve is one of several important wildlife sites within the footprint of the old Bernwood Forest.

2.2.7 Key highways anticipated to be utilised by construction vehicles generated by the Proposed Scheme include Station Road and the A41 between Aylesbury and Bicester.

Figure 2: Area context plan



2.3 Need for the Proposed Scheme and scheme history

2.3.1 The existing railway sidings operated by FCC are located at Calvert on the west side of the Aylesbury Link railway line. Relocation of these sidings is required to accommodate the proposed HS2 Phase One alignment.

2.3.2 The HS2 Phase One ES included the relocation of the sidings to a location on the east side of the Aylesbury Link railway line and the proposed HS2 alignment, to the north of Decoypond Wood. Calvert green overbridge is proposed to span the Aylesbury Link railway line and the proposed HS2 alignment, to provide an access road to the relocated transfer sidings and maintain existing habitat links across the route for bats and other wildlife.

2.3.3 The layout of the sidings and access arrangements were amended in AP4 (which was deposited in October 2015), to include an extension of the sidings to the north, to more closely replicate the existing sidings layout. The introduction of the Calvert sidings overbridge removed the need for landfill traffic to use the Calvert green overbridge.

2.3.4 FCC, BCC, AVDC, the Parish Councils of Charndon and Calvert Green and local residents petitioned against the AP4 scheme on the basis that they considered there would be increased environmental impact for the occupiers of residential properties at Calvert. FCC petitioned also on the basis that the scheme was physically and operationally constrained, compared to the handling capacity of the existing sidings, particularly in combination with the proposed East West Rail Phase 2 (EWR2) upgrade.

2.3.5 FCC proposed an alternative location for the sidings, approximately 1.8km further from Calvert, south of Sheephouse Wood at Greatmoor, Buckinghamshire, opposite the Greatmoor EfW facility.

2.3.6 The proposals for the sidings are shown in Figure 3.

2.3.7 Having considered the matter, the House of Commons Select Committee recognised benefits for local residents in distancing the sidings from the village and indicated a preference for an option south of Sheephouse Wood in the Second Special Report of Session 2015-16[4] recognising that there are ecological sensitivities in this location. The Proposed Scheme is the result of these discussions and has been developed between HS2 Ltd and FCC.

2.3.8 HS2 has agreed to seek the necessary powers and consents by way of a TWAO, for construction of the Proposed Scheme as an alternative to the scheme within the hybrid Bill.

2.3.9 The Proposed Scheme is seeking authorisation outside of the HS2 Phase One hybrid Bill process by way of a TWAO which would be made concurrently with the continued progress of the HS2 Phase One hybrid Bill through Parliament. As a discrete project, though related to the construction of the high speed railway under the hybrid Bill, it is appropriate to seek authorisation for the Proposed Scheme by a TWAO, the

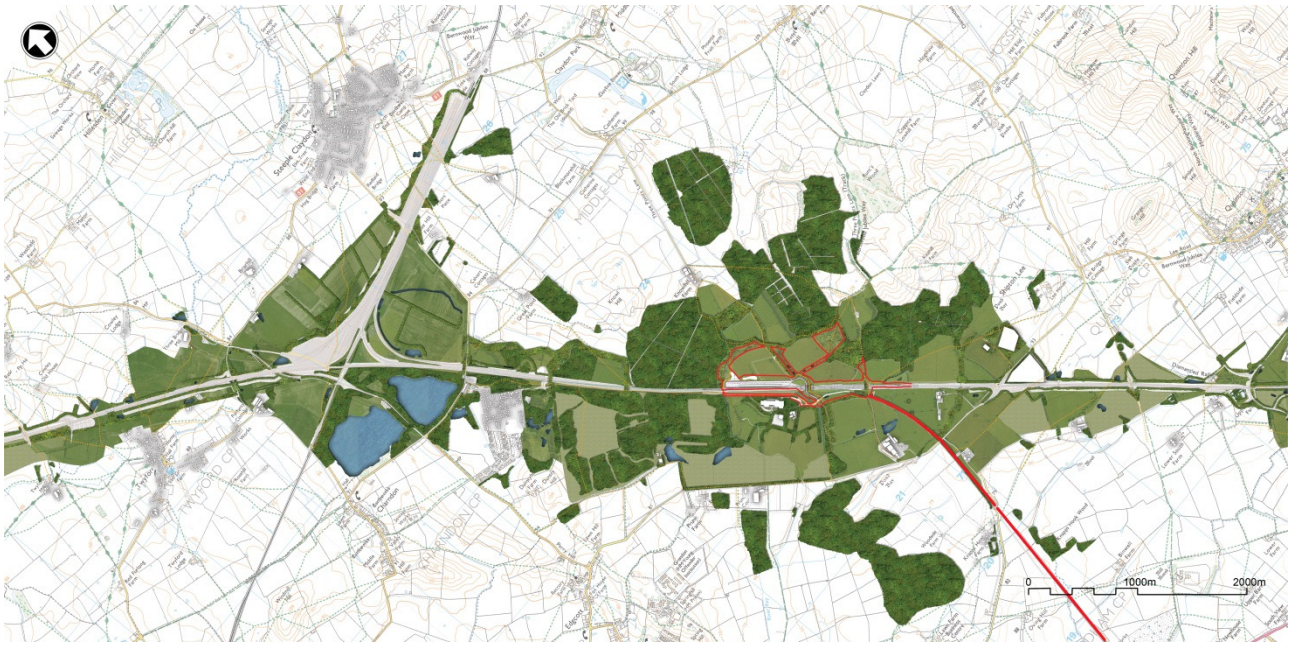
[4] High Speed Rail (London-West Midlands) Bill: Second Special Report of Session 2015-16 page 52 Para 199)

procedure required for obtaining authorisation for railway development and associated infrastructure including any related compulsory land powers.

Figure 3: Comparison plans for the existing and proposed sidings locations

Calvert and the local area showing existing sidings in red line in context (2016)

Calvert and the local area showing the relocated sidings in the HS2 Phase One SES3 and AP4 ES in red line in context (this plan illustrates what the sidings, Greatmoor EfW facility, Calvert landfills and surrounds will look like post restoration)



Calvert and the local area showing the Proposed Scheme in red line in context (this plan illustrates what the sidings, Greatmoor EfW facility, Calvert landfills and surrounds will look like post restoration)

2.4 Description of the Proposed Scheme

2.4.1 The Proposed Scheme is to be situated at Greatmoor, Buckinghamshire between Sheephouse Wood and a point south of Bridleway QUA/36, where the sidings can be connected to the Aylesbury Link railway line. A mitigation plan is shown in Figure 4.

2.4.2 There will be an access for Heavy Good vehicles (HGVs) connecting the sidings to FCC's private access road to the Greatmoor EfW facility (Greatmoor Raod) and the Calvert landfill via Bridleway GUN/28 accommodation green overbridge.

2.4.3 The Proposed Scheme includes railway sidings, bridges, PRoW, vehicular and pedestrian accesses, roads, rail mounted gantry crane, spoil grabs, weighbridge, lighting and mitigation works, including earthworks, drainage, fencing, planting and power connections required to replicate the function of the existing sidings at Calvert operated by FCC and owned by Network Rail. The removal of the existing sidings is part of the proposed HS2 Phase One scheme within the HS2 Phase One hybrid Bill. The civil engineering works for the Proposed Scheme will be managed from the HS2 Phase One Station Road overbridge satellite compound which will act as the main interface with the public highway.

2.4.4 The Proposed Scheme comprises the following (refer to Volume 3: Environmental Statement Maps, Maps ES-01 to ES-03: Construction works sheets; ES-04: Operation Sheet; ES-05: Mitigation context plan, and ES-06: Mitigation Plan):

- the operational (spoil) sidings situated between Sheephouse Wood and Bridleway GUN/28 comprising two pairs of twin tracks with a minimum length of 440m, each pair is connected to enable train engine release / run-a-round, with a line connecting to the reception sidings;
- the operational sidings will include a rail mounted gantry crane (approximately 22m high), capable of handling and stacking two containers and wide enough

for twin tracks, a roadway around the sidings to allow vehicle access for loading and unloading trucks, container storage and management of the sidings. The operational sidings will include two moving spoil grabs (wheel or track mounted excavator) and be capable of servicing either side of the spoil sidings;

- Bridleway GUN/28 accommodation green overbridge, which is a component of the proposed HS2 Phase One scheme, will need to be widened to include vehicular access to the sidings and lengthened to span the additional track linking the operational and reception sidings. The green corridor and the bridleway/accommodation access as shown in the proposed HS2 Phase One scheme remain with environmental mitigation barriers (noise and light) separating the vehicle access and the green corridor. The vehicular access connects with Greatmoor Road;
- Greatmoor Road runs from the A41 to the Greatmoor EfW facility and Calvert landfill site. The Proposed Scheme will realign Greatmoor Road to the west;
- the reception sidings are situated between Bridleway GUN/28 and just beyond Bridleway QUA/36 comprising two railway tracks, connected to the operational sidings as described above;
- a connection to the mainline (Network Rail's Aylesbury Link railway line) will be provided at each end of the reception sidings in order to allow trains to arrive from the north and the south; and
- Bridleway QUA/36 accommodation green overbridge, which is a component of the proposed HS2 Phase One scheme, will need to be lengthened to span the additional tracks of the reception sidings.

2.4.5 A preliminary lighting scheme has been developed for the sidings element of the Proposed Scheme which has informed the landscape and visual and ecology assessments in the ES. The scheme comprises the following:

- low level bollard lighting alongside each of the reception sidings as is required for wayfinding for train drivers walking alongside stabled trains in the hours of darkness (design luminosity: 10lux);
- low level bollard lighting along one side of the access road between the junction with Greatmoor Road and the sidings, including across GUN/28 accommodation green overbridge (design luminosity: average of 5 lux with a minimum of 1 lux);
- 6m high lighting columns along the western edge of the waste sidings and 10m high lighting columns on both sides of the spoil sidings (design luminosity: average 30 lux); and
- LED lighting fixed to the rail mounted gantry crane, which will move along the full length of the waste sidings (design luminosity: average of 50 lux) beneath the crane.

2.4.6 To limit the impacts on bats the lighting design for the terminal will include environmental mitigation barriers (noise and light) installed around much of the eastern side of the sidings area of the Proposed Scheme. This will be 4m high.

2.4.7 The following train movements have been assumed during operation of the Proposed Scheme on a reasonable worst case basis in this ES:

- up to 8 freight trains per day (16 train movements per day) accessing the sidings via the Aylesbury Link railway line (5 spoil trains (10 movements) per day (going to Calvert landfill) and 3 waste trains (6 movements) per day (going to the Greatmoor EfW facility)); and
- 1 passenger train per hour each way (2 train movements per hour) on the Aylesbury Link railway line (as part of the EWR2 upgraded services).

2.4.8 The maximum capacity/worst case scenario is as follows:

- each excavated material train offload requires 90 HGV movements – with each HGV picking up a load from the sidings, depositing it at Calvert landfill. HGVs are A25s or A30s.
- each waste train offload requires 66 HGV movements - with each HGV picking up a load from the sidings, depositing it at the Greatmoor EfW facility. HGVs are HGVs are A25s or A30s.
- total HGV movements will be 648 (3 waste plus 5 spoil trains).

2.4.9 The operating hours are expected to be in line with the current operational hours of the existing sidings at Calvert; i.e. 0500-2300 Monday to Friday and from 0700 to 1600 on Saturdays except where noted in 2.4.10 below.

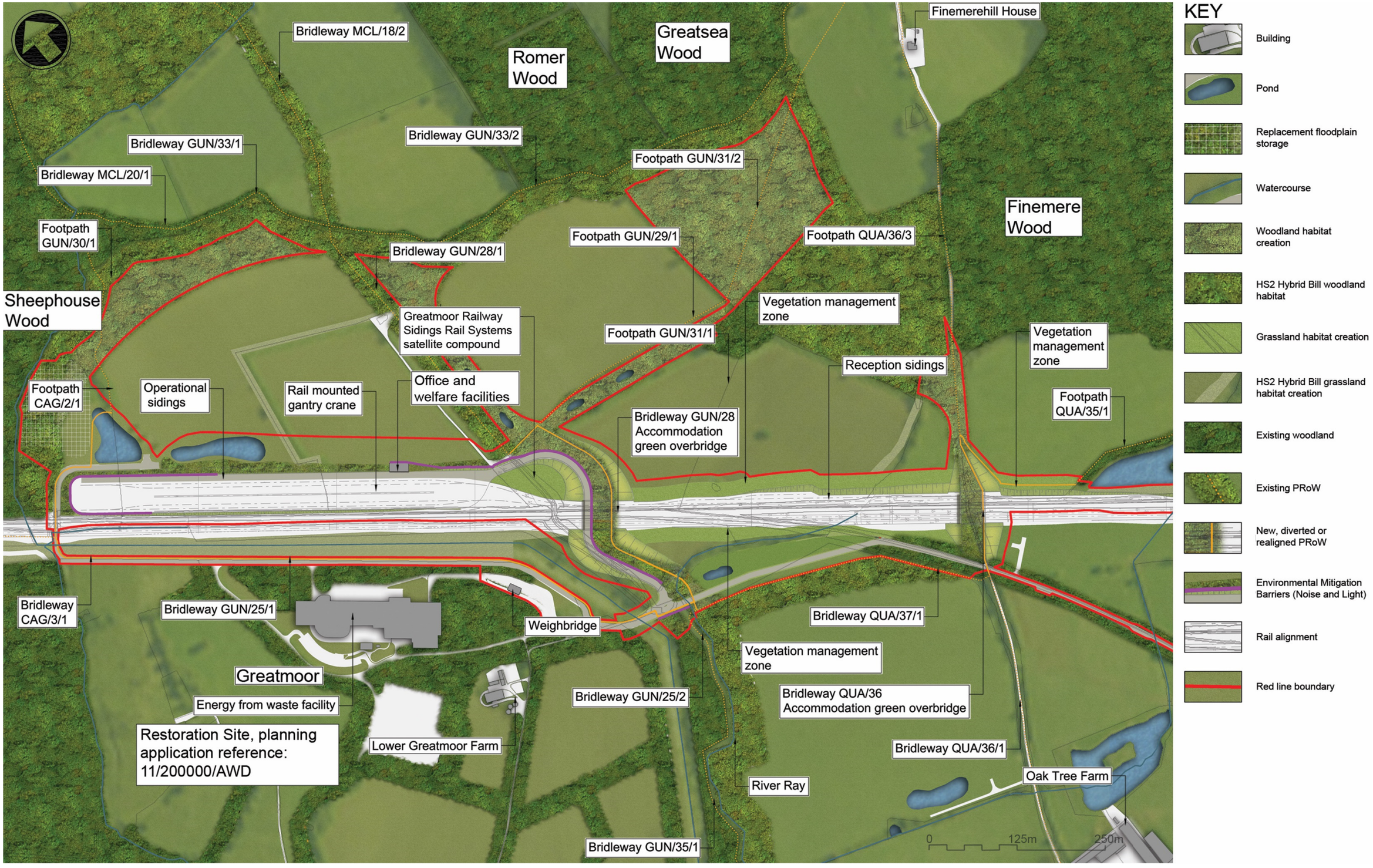
2.4.10 Night time operation of the Proposed Scheme will be restricted during March to October when bats are most active, so that HGV movements across the Bridleway GUN/28 accommodation green overbridge (between the operational sidings and the Greatmoor EfW facility) will take place during the day and avoid any material overlap with sunrise or sunset. The Planning Direction proposes a condition to give effect to this mitigation measure.

2.4.11 Due to the environmental sensitivities in the area (i.e. the presence of bats), the hours of operation and the use of external lights for the unloading and loading of trains will be restricted from March through to October, to avoid disturbance from light and noise. Trains will, however, be able to arrive and depart at any time (including the night). The sidings will potentially be lit between 0500 and 2300 during hours of darkness in the winter months (November to February) but for shorter hours during the rest of the year, when the bats are active.

2.4.12 Further details on lighting hours are contained within the report on "Operational Timing Restrictions to Minimise Effects on Bats", June 2016 (refer to Volume 4.01: Environmental Statement Technical Appendix: Additional information).

2.4.13 Upon arrival at the facility, trains outside operational hours will stop up where allocated, engines and external lighting will be switched off no later than 30 minutes after arrival. Outside operational hours stationary train engines will not be left to run idle and external lights will be extinguished.

Figure 4: Mitigation plan



2.5 Incorporated design measures

2.5.1 The mitigation plan (shown in Figure 4) has been produced across the site which incorporates the following measures into the design:

- woodland habitat creation along existing field boundaries additional to HS2 hybrid Bill woodland habitat, to create more substantial bat corridors;
- additional ecological mitigation ponds will be integrated through proposed planting;
- replacement flood storage sympathetically integrated into the existing landscape;
- areas of grassland habitat creation are used to create vegetation management areas to discourage bats from flying along the line of HS2;
- balancing ponds to be integrated through mitigation planting;
- environmental mitigation barriers (noise and light) are proposed around much of the sidings area of the Proposed Scheme;
- landscape mitigation for Bridleway GUN/28 accommodation green bridge to integrate Greatmoor Railway Sidings access road and to establish an effective bat corridor and maintain bridleway accessibility across the railway; and
- landscape mitigation for Bridleway QUA/36 accommodation green bridge to establish an effective bat corridor and maintain bridleway accessibility across the railway.

2.5.2 Landscape mitigation associated with the Proposed Scheme aims to integrate the Proposed Scheme into the existing landscape, while maintaining PRoW in their existing location. The green bridges over the line and underpasses will ensure that the existing good connectivity of PRoW is not changed and the Proposed Scheme does not introduce new barriers to north-south movement through the landscape. The green bridges will maintain ecological connectivity for local bats. Visitors to the area will be able to continue to make use of the extensive footpath network linking attractions across the area during operation.

2.6 Community consultation and engagement

2.6.1 HS2 Ltd. has sought to engage and consult with affected parties via a range of methods including distributing letters, arranging meetings and holding a public engagement event.

2.6.2 A report has been produced by HS2 Ltd which details the outcome of the consultation and engagement undertaken[5], however a summary is as follows.

2.6.3 Statutory consultees were sent a letter describing the proposals, with plans showing the location of the Proposed Scheme, the construction layout and the proposed

[5] High Speed Rail (London – West Midlands) (Greatmoor Railway Siding etc.) Order, Rule 10(2) (d), Summary of Consultations Undertaken, 2016

operational layout. Meetings were undertaken to present the proposals and scheme development with key statutory stakeholders such as BCC, AVDC, Natural England, Network Rail and the EA.

2.6.4 HS2 Ltd. wrote to landowners and parties with an interest in the land affected by the TWAO in order to establish land ownership information and to inform affected parties of the proposals. These letters included contact details to which queries regarding the Proposed Scheme could be sent

2.6.5 Amenity groups were issued a copy of the letter that was sent to Statutory Consultees describing the proposals. Meetings were also arranged to present the proposals and scheme development with a number of these amenity groups including BBOWT and the Bernwood Bechstein's Bat Project.

2.6.6 A public engagement 'drop-in' event was held on the 25th May 2016 to raise awareness of the Proposed Scheme.

2.6.7 The consultation exercise took place over a period of approximately 5 months prior to submission of the application.

2.6.8 No objections in principle to the Proposed Scheme have been received in response to the formal consultation. A number of detailed points, predominantly in respect of ecology and bats were received and HS2 Ltd. has held informal discussions with stakeholders to address the concerns raised.

2.6.9 Approximately 500 residents were invited to the public engagement event on the 25th May 2016, and around 50 to 60 people attended. Attendees included representatives of the County, District and Parish Councils as well as residents. Five responses were submitted to the ballot box. Each of these 'strongly agreed' with the proposal to relocate the sidings south of Sheephouse Wood.

2.6.10 These same residents were also sent a mailshot requesting feedback. Sixty-eight responses to the mailshot were received. Of these:

- 49 residents strongly agreed with the proposals to relocate the sidings;
- 14 residents agreed with the proposals to relocate the sidings;
- 1 resident is 'undecided' as to whether moving the sidings is beneficial or not;
- 1 resident disagreed with the proposal to relocate the sidings; and
- 3 residents strongly disagreed with the proposals to move the sidings.

2.7 Construction strategy

Overview and assumptions

2.7.1 If the TWAO is made, the Proposed Scheme will be constructed as part of the HS2 Phase One hybrid Bill works. As such, construction will be in compliance with the HS2 Phase One draft Code of Construction Practice (CoCP) as finalised. The current draft CoCP is included in Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP.

2.7.2 General provisions relating to the construction process are set out in more detail in the draft CoCP.

2.7.3 The sidings will be constructed in the following stages:

- enabling works, including site investigations further to those already undertaken, preliminary mitigation works, including early planting and preliminary enabling works;
- civil engineering works, including establishment of Station Road overbridge satellite compound, site preparation, enabling works and bridge construction;
- civil engineering works, including earthworks, culvert works, road construction, rail mounted gantry crane foundations and site restoration; and
- railway installation works, including establishment of Greatmoor Railway Sidings Rail Systems satellite compound, infrastructure installation and connections to utilities.

2.7.4 Enabling works will be required before commencing construction works and will typically include:

- further detailed site investigations and surveys;
- further detailed environmental surveys;
- mitigation works including, early planting where appropriate, contamination remediation (if present), temporary habitat creation and translocation, and built heritage survey and investigation;
- site establishment with temporary fence construction; and
- utility diversions.

2.7.5 The civil engineering works will be managed from Station Road overbridge satellite compound, located approximately 3.5km south east of land required for the Proposed Scheme. An access road will be constructed along the HS2 Phase One trace (route) to the site of Bridleway GUN/28 accommodation green overbridge. This will provide the main access for construction of the Proposed Scheme and act as the main interface with the public highway at Station Road, Quainton. The compound and access will be within the limits of the HS2 Phase One hybrid Bill and are not covered by the TWAO.

2.7.6 Decommissioning and removal of the existing sidings at Calvert are not covered by the TWAO and will be undertaken as part of the HS2 Phase One scheme.

2.7.7 The Proposed Scheme is to be constructed while the Aylesbury Link railway line remains operational for freight trains serving the existing railway sidings currently located at Calvert. Generally, work will be carried out during core working hours as defined in the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP), however evening and weekend possessions will be required for safe working in close vicinity to the railway.

2.7.8 Greatmoor Railway Sidings Rail Systems satellite compound will be located to the east of the existing Aylesbury Link railway line.

2.7.9 Access along Greatmoor Road will be required during construction for new utility supplies for the Proposed Scheme and for access to the Greatmoor Railway Sidings Rail Systems satellite compound. It will also provide maintenance access for Network Rail purposes at the operational phase. Greatmoor Road is not proposed to be used for civil engineering works construction traffic.

2.7.10 The northern section of Greatmoor Road will be realigned to allow the western approach embankments to Bridleway GUN/28 accommodation green overbridge to be constructed. A temporary level crossing will be put in place on the Aylesbury Link railway line to allow construction access to the east side of the railway. This will be used until Bridleway GUN/28 accommodation green overbridge is completed, which will then provide the required access.

2.7.11 Construction of the embankments for the sidings will take place using excavated material from HS2 Phase One to reduce the need to import material from external sources. It is expected that this material will have been excavated locally to minimise haulage distances. Excavated material from the reception sidings cutting will be re-used for embankment construction where suitable.

2.7.12 The land adjacent to the sidings identified for material storage will be used for storing topsoil and subsoil stripped as part of the works prior to it being placed locally as part of the proposed woodland and ecological planting, and for engineering earthworks and green bridges.

2.7.13 The retaining wall supporting the existing Aylesbury Link railway line at a higher level than the adjacent reception sidings will be constructed during a series of evening and weekend possessions due to the proximity to the operational railway.

2.7.14 On completion of the earthworks the sub-base and road construction for the sidings access road via Bridleway GUN/28 accommodation green overbridge will commence. This will provide suitable access for the rail mounted gantry crane foundations to be constructed. This will be on piled foundations with a continuous ground beam running the full length of each side of the container sidings.

2.7.15 Installation of new track and railway systems for the sidings will generally take place during standard working hours, although some mid-week night possessions will be required for material delivery and preparation. Construction of connections to the existing track will require a series of weekend possessions.

2.7.16 The rail mounted gantry crane will be installed over the container sidings and then a period of testing and commissioning will take place before the new sidings becomes operational.

2.7.17 Generally construction activities will be carried out during standard working hours but some night time working will be required for work on the retaining wall of the existing Aylesbury Link railway line, for realignment of the access road to the Greatmoor EfW facility. These activities are likely to be sporadic and of short duration and will not significantly affect bat foraging and commuting activity.

Construction description

2.7.18 Enabling works will take place in 2017 for approximately three months.

2.7.19 For this TWAO, Station Road overbridge satellite compound will be used for only the civil engineering works (sidings construction). The satellite compound will:

- be operational for approximately two years and three months, starting in 2017;
- support approximately 45 workers each day throughout much of the civil engineering works period, which will increase to a maximum of approximately 75 workers each day during the peak period of activity;
- not provide worker accommodation facilities;
- be accessed via the M40, A41 and Station Road from the west and via the M1, A4146, A418, A41 and Station Road from the east; and
- be managed from the A41 Bicester Road embankment main compound (part of the HS2 Phase One scheme) located at Fleet Marston to the north of Aylesbury.

2.7.20 As part of this TWAO, Greatmoor Railway Sidings Rail Systems satellite compound will be used for railway installation works. The compound will manage the installation of tracks and rail systems for the sidings and will:

- be operational for approximately 12 months, from the start of 2019 to the end of 2019;
- support approximately 40 workers each day throughout much of the rail systems installation works period, which will increase to a maximum of approximately 50 workers each day during the peak period of activity;
- not provide worker accommodation facilities;
- be accessed by workers via the M40, A41 and Greatmoor Road from the west and via the M1, A4146, A418, A41 and Greatmoor Road from the east;
- be accessed for material deliveries via the existing rail network; and
- be managed from the Calvert railhead main compound (part of the HS2 Phase One scheme) located at Fleet Marston to the north of Aylesbury.

2.7.21 There will be no access by road from the Station Road overbridge satellite compound to the Greatmoor Railway Sidings Rail Systems satellite compound as all construction access will be along the HS2 trace.

2.7.22 Demolition of one structure will be required. This is the railway bridge at Benfields, located in Greatmoor.

2.7.23 Diversion of one private road will be required. This is the Greatmoor Road which provides access to the Greatmoor EfW facility. The majority of works will be undertaken offline while the existing road remains open. Construction of links at either end of the diversion will take place at evenings or weekends when the road is not in use.

2.7.24 Construction of the Proposed Scheme will result in the following impacts upon PRoW:

- Bridleway QUA/36/2 & QUA/36/3 will be temporarily stopped up during construction of Bridleway QUA/36 accommodation green overbridge. An alternative route via other existing PRoW, of approximately 630m additional distance, will be provided. Following construction, this PRoW will be permanently diverted to Bridleway QUA/36 accommodation green overbridge, with a negligible change in distance;
- Footpath QUA/35/1 will be temporarily stopped up during construction of Bridleway QUA/36 accommodation green overbridge. An alternative route of approximately 100m additional distance, will be provided. Following construction, this PRoW will be permanently diverted around Bridleway QUA/36 accommodation green overbridge embankment, with an additional distance of 100m;
- Bridleway QUA/37/1 will be temporarily stopped up during the creation of woodland habitat. A minor diversion of negligible additional distance, will be provided;
- Bridleway GUN/35/1 will be temporarily stopped up during the creation of woodland habitat. A minor diversion of negligible additional distance, will be provided;
- Bridleway GUN/30/1 will be temporarily stopped up during the creation of woodland habitat, with a minor diversion of negligible additional distance provided;
- Bridleway GUN/31/2 will be temporarily stopped up during the creation of woodland habitat. A minor diversion of negligible additional distance, will be provided;
- Footpath GUN/31/1 will be temporarily stopped up during construction of Bridleway GUN/28 accommodation green overbridge. A temporary diversion, of approximately 200m additional distance, will be provided. Following construction, this PRoW will be permanently diverted to Bridleway GUN/28 accommodation overbridge, with an additional distance of 200m;
- Footpath GUN/29/1 will be temporarily stopped up during construction of Bridleway GUN/28 accommodation green overbridge. A temporary diversion, of no additional distance, will be provided. Following construction, this PRoW will be permanently diverted around GUN/28 accommodation green overbridge approach ramp, with a negligible change in distance;
- Footpath CAG/2/1 will be temporarily stopped up during construction of Footpath CAG/2 underbridge. An alternative route via other existing PRoW, of approximately 1.9km additional distance, will be provided. Following construction, this PRoW will be permanently diverted around a balancing pond and the sidings, then beneath Footpath CAG/2 underbridge once constructed, with an additional distance of 50m;
- Bridleway GUN/28/1 will be temporarily stopped up during construction of Bridleway GUN/28 accommodation green overbridge. An alternative route via other existing PRoW, of approximately 300m additional distance, will be

provided. Following construction, this PRoW will be permanently diverted to Bridleway GUN/28 accommodation green overbridge, with a negligible change in distance;

- Footpath QUA/24A/1 will be temporarily stopped up during utility works on Greatmoor Road. A minor diversion of negligible additional distance, will be provided;
- Footpath WOD/1/4 will be temporarily stopped up during utility works on Greatmoor Road. A minor diversion of negligible additional distance, will be provided;
- Bridleway GUN/25/2 will be permanently stopped up following construction of the Proposed Scheme. An alternative route via other PRoW, of a negligible change in distance, will be provided;
- Bridleway GUN/25/1 will be permanently stopped up following construction of the Proposed Scheme. An alternative route via other PRoW, of 2.2km additional distance, will be provided; and
- Bridleway CAG/3/1 will be permanently stopped up following construction of the Proposed Scheme. An alternative route via other PRoW, of 2.2km additional distance, will be provided.

2.7.25 All of these changes to PRoW, apart from five (PRoW QUA/37/1, GUN/35/1, GUN/29/1, QUA/24A/1 and WOD/1/4), would be required as part of the HS2 Phase One scheme and the Proposed Scheme makes no change to this

2.7.26 Permanent diversion of one utility and the installation of four new utilities will be required, the key ones being:

- a 33kV electrical underground cable will need to be diverted beneath the new sidings so that an inspection chamber can be located outside of the operational sidings. The distance of the diversion is negligible;
- a potable water supply will be installed to the welfare facilities via Bridleway GUN/28 accommodation green overbridge;
- a low voltage electric supply will be installed to the welfare facilities, the operational sidings lighting, reception siding lighting and rail mounted gantry crane via Bridleway GUN/28 accommodation green overbridge;
- a foul water supply will be installed to the welfare facilities via Bridleway GUN/28 accommodation green overbridge; and
- a telecommunication cable will need be installed to the welfare facilities via Bridleway GUN/28 accommodation green overbridge.

2.7.27 Permanent diversion of two watercourses will be required:

- a watercourse (drain/ditch) at Greatmoor Farm, which will require a diversion of approximately 300m to the north with a culvert crossing under the railway; and

- a watercourse (drain/ditch) at Lower Greatmoor Farm, which will require a diversion of approximately 500m to the north with a culvert crossing under the railway.

Indicative construction programme

2.7.28 An indicative construction programme is shown in Table 3.

Table 3: Indicative construction programme phasing diagram

	2017 Quarters				2018 Quarters				2019 Quarters			
Activity	1	2	3	4	1	2	3	4	1	2	3	4
Enabling works												
Early works (planting)												
Civil engineering works												
Station Road overbridge satellite compound												
Bridleway QUA/36 accommodation green overbridge												
Greatmoor Road Realignment												
Bridleway GUN/28 accommodation green overbridge												
Reception Sidings Cutting												
Operational Sidings Cutting												
Operational Sidings Embankment												
Culverts under the railway sings and railway line												
Sidings access road and rail mounted gantry crane												

	2017 Quarters				2018 Quarters				2019 Quarters			
Activity	1	2	3	4	1	2	3	4	1	2	3	4
Rail infrastructure and systems works												
Greatmoor Railway Sidings Rail Systems satellite compound												
Sidings rail installation												
Commissioning												

Key:

Compound duration

Construction works

3 Consideration of alternatives and options

3.1.1 The ES is required to report the main alternatives to the Proposed Scheme, where these have been considered. This section summarises the alternative site options considered by the Promoter

3.1.2 The HS2 Phase One hybrid Bill (as deposited in November 2013) included the reinstatement of the sidings to a location on the east side of the Aylesbury Link railway line and the proposed HS2 alignment, to the north of Decoypond Wood. Calvert green overbridge was proposed to span the Aylesbury Link railway line and the proposed HS2 Phase One alignment, to provide an access road to the relocated transfer sidings and maintain existing habitat links across the route for bats and other wildlife.

3.1.3 The layout of the sidings and access arrangements were amended in AP4 (which was deposited in October 2015), to include an extension of the sidings to the north, to more closely replicate the existing sidings layout, and the introduction of the Calvert sidings overbridge removing the need for sidings traffic to use the Calvert green overbridge. This scheme has been considered as an option and is described in this ES as the SES3 and AP4 option (though this has now been incorporated into the hybrid Bill scheme).

3.1.4 Since the SES3 and AP4 ES, four options were assessed to identify which location south of Sheephouse Wood would have the least environmental impact. The four options considered were as described below:

- Option SK10 - splayed sidings layout at approximately 45 degree angle from the existing Aylesbury Link railway line with a combined farm accommodation, green overbridge and vehicle access;
- Option SK11 - splayed sidings layout at approximately 45 degree angle from the existing Aylesbury Link railway line with an accommodation green overbridge and separate vehicle underpass;
- Option SK13 - parallel sidings layout to the existing Aylesbury Link railway line with a farm accommodation, green overbridge and separate vehicle underpass; and
- Option SK14 - (refined from SK12) parallel sidings layout to the existing Aylesbury Link railway line with a combined farm accommodation, green overbridge and vehicle access and associated wider planting.

3.1.5 A study of the alternative site options for relocating the sidings was undertaken and the advantages and disadvantages are summarised in Table 4.

Table 4: Assessment of alternative site options

Alternative option	Advantages	Disadvantages
SES_3 and AP_4 ES option	Ecology: Location is outside the core area used by breeding Bechstein's bats. The area is used by other bats including non-breeding Bechstein's bats. Ecology: Further away from SSSI designated sites.	Community: Closer to residential receptors in Calvert. Ecology/Biodiversity: Closer to Decoypond Wood ancient woodland. Engineering: Reduced operational efficiency and capacity of the sidings. Landscape and Visual: Requires construction of Calvert sidings overbridge with associated visual impacts.
Option SK10	Community: Further from residential receptors in Calvert than SES_3 and AP_4 ES option. Engineering: Increased operational efficiency and capacity of the sidings over SES_3 and AP_4 ES option.	Ecology/Biodiversity: Closer to Sheephouse Wood SSSI. Ecology/Biodiversity: This option will have a likely major impact on bat flightpaths as the positioning of the sidings under this option is within 100m of the Three Points Lane flight path and the key intersection of flight paths for a suite of woodland bat species including Bechstein's at the junction of Hewin's Wood and the Mega Ditch. Landscape and visual: Affects a wider area due to its splayed layout. HGVs using the overbridge will be prominent in the landscape and views, especially from the PRoW and Finemere House.
Option SK11	Community: Further from residential receptors in Calvert than the SES_3 and AP_4 ES option. Engineering: increased operational efficiency and capacity of the sidings over the SES_3 and AP_4 ES option. Landscape and visual: HGVs using the underpass will be less visible in the landscape and views than those using an overbridge.	Ecology/Biodiversity: Closer to Sheephouse Wood SSSI. Ecology/Biodiversity: Bats are likely to be diverted up and over the underpass at an unsafe height with the increased risk of bats colliding with trains. Ecology/Biodiversity: This option will have a likely major impact on bats as the positioning of the sidings under this option is within 100m of the Three Points Lane flight path and the key intersection of flight paths for a suite of woodland bat species including Bechstein's at the junction of Hewin's Wood and the Mega Ditch. Landscape and Visual: Small additional loss of land. This option affects a wider area due to its splayed layout.
Option SK13	Community: Further from residential receptors in Calvert than the SES_3 and AP_4 ES option. Ecology/Biodiversity: The positioning of the sidings parallel to the rail corridor will contain the additional disturbance to an area already affected by train movements reducing any likely effects on foraging habitat and flight paths. Engineering: Increased operation and capacity	Ecology/Biodiversity: Closer to Sheephouse Wood SSSI. Ecology/Biodiversity: Bats are likely to be diverted up and over the underpass at an unsafe height with the increased risk of bats colliding with trains. Ecology/Biodiversity: The positioning of the sidings parallel to the rail corridor will contain the additional disturbance to bats to the junction of Hewin's Wood

Alternative option	Advantages	Disadvantages
	of the sidings over the SES3 and AP4 ES option. Landscape and Visual: Affects a smaller area than the splayed sidings. HGVs using the underpass will be less visible in the landscape and views than those using an overbridge.	and the Mega Ditch. However, this may result in reduced use or abandonment of existing flight paths or bats starting to use new unmitigated flight routes.
Option SK14 (refined from SK12)	Community: Further from residential receptors in Calvert than the SES3 and AP4 ES option. Engineering: increased operation and capacity of the sidings over the SES3 and AP4 ES option. Landscape and Visual: This option affects a smaller area than the splayed options.	Ecology/Biodiversity: Closer to Sheephouse Wood SSSI. Ecology/Biodiversity: The positioning of the sidings parallel to the rail corridor will contain the additional disturbance to the junction of Hewin's Wood and the Mega Ditch. However, this may result in reduced use or abandonment of existing flight paths or bats starting to use new unmitigated flight routes, albeit to a lesser extent than option SK13. Landscape and Visual: HGVs using the overbridge will be prominent in the landscape and views, especially from the PRoW and Finemere House. However, the planting will go some way to mitigate this effect.

3.1.6 The SES3 and AP4 option was found to have a reduced operational efficiency and capacity of the sidings when compared to options SK10, SK11 and SK14. It was also closer to the residential the area of Calvert. An advantage of the SES3 and AP4 option was its distance from Sheephouse Wood SSSI and other sensitive habitats with likely reduced effects on protected bat species.

3.1.7 Option SK10 was found to have greater disadvantages for landscape and visual and ecology than any of the other options. This was due to the larger area of land required for the splayed sidings.

3.1.8 Options SK11 and SK13 had disadvantages which were related to the proposed underpass, as bats are likely to be diverted up and over the underpass at an unsafe height with the increased risk of bats colliding with trains.

3.1.9 Option SK10 and SK11 had the disadvantage that the location of the sidings would be likely to have a major effect on bats using the Three Points Lane flight path and the key intersection of flight paths for a suite of woodland bat species including Bechstein's at the junction of Hewin's Wood and the Mega Ditch.

3.1.10 The positioning of the sidings parallel to the rail corridor in option SK13 and SK14 would contain the additional disturbance to bats using the junction of Hewin's Wood and the Mega Ditch. However, this may have resulted in reduced use or abandonment of existing flight paths or bats starting to use new unmitigated flight routes. Of the two options, this effect was considered to be to a lesser extent for Option SK14 than SK13.

3.1.11 Options SK13 and SK14 were found to have fewer adverse impacts on biodiversity and landscape and visual in operation than the other options because it affects a smaller

area than both the splayed sidings and would contain impacts to an area adjacent to the existing rail corridor.

3.1.12 For the reasons described above, Option SK14 was considered to be progressed as the preferred option which has been further refined into the Proposed Scheme.

4 EIA methodology

4.1 Overview

4.1.1 This section outlines the general approach undertaken for the EIA. Further details regarding the specific methodologies used for each technical discipline are presented in the relevant discipline sections and, where appropriate, described in further detail in the relevant reports in the Volume 4: Environmental Statement Technical Appendices.

4.2 Scope of the EIA

4.2.1 The ES has considered the construction and operational effects on the following environmental topics, based on the requirements of the EIA Regulations:

- Agriculture, forestry and soils;
- Air quality;
- Community;
- Cultural heritage;
- Ecology;
- Land quality;
- Landscape and Visual assessment;
- Sound, noise and vibration;
- Traffic and transport; and
- Water resources and flood risk assessment.

4.3 General approach to TWAO EIA

4.3.1 Applications for Transport and Works Act Orders are made in accordance with the Transport and Works (Applications and Objections Procedure) (England and Wales) Rules 2006 ("the Applications Rules").

4.3.2 The Proposed Scheme is considered to be an Annex II EIA development as described in the European Council Directive 85/337/EEC and its subsequent amendments[6] as set out in paragraph 10 "Infrastructure Projects; (d) Construction of railways (unless included in Schedule 1)".

4.3.3 The undertaking of an EIA and preparation of an ES is in accordance with Rule 7(1) of the Application Rules, which requires an applicant to submit, with the TWA order application, the applicant's "Statement of Environmental Information". Provision for a Screening Decision is also made under Rule 7. However, the Proposed Scheme is, as

[6] 97/11/EC, 2003/35/EC and 2009/31/EC

stated above, an Annex II EIA development and so a formal application to the Secretary of State for a screening decision was not required.

4.3.4 The ES assesses the construction and operational impacts that may arise from the Proposed Scheme, including the phasing or other cumulative impacts that may result and national, regional and local policy and regulations and includes the following information:

- description of the Proposed Scheme;
- main alternatives considered;
- description and supporting data in relation to the likely significant effects of the development on the surrounding area;
- details of the measures proposed to avoid, reduce or mitigate outstanding significant effects on the environment; and
- any limitations, assumptions or uncertainties of the studies undertaken.

4.3.5 The Non-Technical Summary (NTS) included in Volume 1 covers the key baseline issues identified during the EIA process, the mitigation measures and residual effects likely to result from the development. This has been presented in an accessible style for the non-technical reader.

4.3.6 The scope, key assumptions and limitations for the technical assessments are as set out in the HS2 Phase One ES, Volume 5, Scoping and Methodology report (the SMR), and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

4.3.7 Additional updates for certain environmental topics were made during the SES and AP process. Further updates have been made for the assessment due to the nature of the Proposed Scheme. Where such updates have occurred, it is identified in the relevant topic sections. The sections below also identify where the methodology for any of the assessments will differ, including any assumptions.

4.3.8 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This document details the procedures that will be employed during the construction phase of the Proposed Scheme to ensure that adverse effects upon environmental and sensitive local receptors are suitably managed, mitigated and monitored.

4.4 Environmental baseline

4.4.1 Significant environmental effects are described in terms of the extent of change to the baseline environment. Each technical section has identified the spatial extent of the study area used for the baseline assessment. The study area has varied between disciplines depending on industry best practice.

4.4.2 The baseline information has been projected forward in order to predict the baseline information prior to the commencement of construction and during operation of the Proposed Scheme (the "future baseline"). The EIA has used the following baseline years on which to carry out the assessment:

- Existing baseline – assessment year 2016 (current situation); and
- Future baseline:
  - the assessment year for construction is 2017 (2019 for traffic and related topics) ; and
  - the assessment year for operation is 2019.

4.4.3 The construction of the Proposed Scheme would be progressed as part of the construction of HS2 Phase One and not as a stand-alone project. If the TWAO is confirmed by the Secretary of State, the accommodation works associated with the relocation of the existing FCC sidings as described in the HS2 Phase One hybrid Bill (as enacted) would not be undertaken.

4.4.4 The environmental impacts assessed in this ES will be in addition to, or in place of, those assessed HS2 Phase One ES and SES. Where applicable, these similarities or differences are explained further in the individual topic sections in this ES.

4.4.5 The construction phase of the HS2 Phase One scheme is included in the future baseline for both construction and operation of the Proposed Scheme.

4.4.6 The Greatmoor EfW facility is included in the existing baseline (2016) as it is operational. The operation of the Greatmoor EfW facility also forms part of the future baseline for both construction and operation of the Proposed Scheme. The requirements of the Environmental Permit for this facility have been used to inform the assessment in this ES.

4.4.7 Calvert landfills (Pits 4, 5 and 6) operated by FCC form part of the existing baseline (2016). Operation of the landfills forms part of the future baseline for both construction and operation of the Proposed Scheme.

4.4.8 The Greatmoor Environmental Landscape Restoration Planting masterplan (GR3/1, June 2011, see Volume 4.01: Environmental Statement Technical Appendix: Additional information) shows the expected phased landscape restoration for the Greatmoor EfW facility and Calvert landfills which will be implemented over the life of these developments and undertaken by the operator FCC.

4.4.9 The EWR2 upgrade proposes to upgrade the existing Aylesbury Link railway line and bring into use disused sections of railway to increase the frequency of train services. Construction of EWR2 is expected to commence in April 2019. As such, construction of EWR2 forms part of the future baseline for operation of the Proposed Scheme. EWR2 is expected to be operational in 2022. The EWR2 upgrade will be entirely within the railway corridor. Information of the EWR2 upgrade has been taken from the EWR website[7].

4.5 Identification of likely significant environmental effects

4.5.1 The ES identifies both beneficial and adverse impacts on environmental resources or receptors, and assesses whether the resulting effects are likely to be significant. The

[7] Website: http://www.eastwestrail.org.uk/

likelihood that an impact will give rise to a significant environmental effect depends on a number of factors, such as the magnitude of the impact and the sensitivity of the receiving environment. Whilst the ES focuses on the reporting of likely significant effects, it also assesses the level of impact that gives rise to them, explains how adverse effects will be mitigated and reports the likely residual effect.

4.5.2 The predicted impacts and effects have generally been classified according to whether they are beneficial, adverse or negligible as follows:

- beneficial: advantageous or positive change to an environmental resource or receptor;
- adverse: detrimental or negative change to an environmental resource or receptor; and
- negligible: imperceptible change to an environmental resource or receptor.

4.5.3 They have been further categorised as low/minor, medium/moderate or high/major, however the definition of each category varies by topic, as shown in the SMR and SMR Addendum (refer to Volume 4.01: Environmental Statement Technical Appendix: Additional information). These terms have generally been defined as follows, unless otherwise specified:

- low impact/minor effect: slight change (very short-term in duration and/or highly localised);
- medium impact/moderate effect: limited change (moderate extent, duration and/or magnitude); and
- high impact/ major effect: considerable change (long term duration, extent and/or magnitude) of more than local importance.

4.5.4 The duration of impacts has been defined as either temporary or permanent. They can occur either directly or indirectly. Direct impacts are those that will arise directly from construction or operation of the Proposed Scheme (e.g. due to the land required). Indirect impacts are those that arise from consequential changes associated with the Proposed Scheme.

4.5.5 Variations to the definition of impacts that have been developed since the publication of the Scoping Report are described in the SMR Addendum or in the sections below where necessary. Where it is not possible to quantify impacts or their consequential effects, qualitative assessments have been carried out, based on professional judgement. Where uncertainty exists, and assumptions have had to be made, these are explained in the relevant discipline sections.

4.5.6 Effects deemed to be significant have been evaluated against recognised standards and accepted criteria for each environmental topic, where these are available. Where no recognised standards or criteria exist, professional judgement has been used.

4.6 Climate change

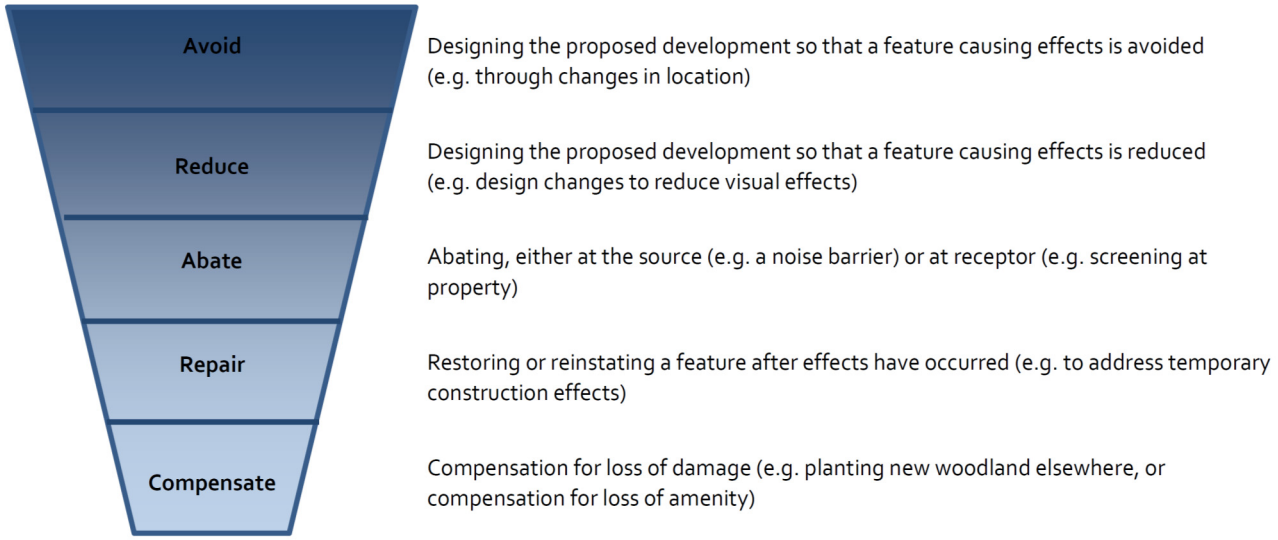
4.6.1 Climate change has been taken into account within each of the technical sections as part of the assessment. It is not anticipated that future predictions of climate change will have any effect on the proposed use of the Proposed Scheme. The Proposed

Scheme also does not include construction or operational uses and activities that will generate emissions at a scale that have the potential to cause significant adverse or beneficial effects for climate.

4.7 Mitigation

4.7.1 The EIA Regulations require an ES to include "a description of the measures envisaged in order to avoid, reduce and, if possible, remedy significant adverse effects". Such measures are described generically in this ES as mitigation measures. The approach to mitigation adopted for the Proposed Scheme has a hierarchy, whereby priority has been given to avoiding or preventing effects; and then (if this was not possible), to reducing or abating them; and then, if necessary, to offsetting them through repair (restoration or reinstatement) or compensation. The hierarchy is illustrated in Figure 5.

Figure 5: Mitigation hierarchy



4.8 Cumulative effects

4.8.1 Cumulative effects are those that result from a combination of a number of individual effects. They may result either from a combination of effects arising from the Proposed Scheme (intra-project effects) or from an interaction between the effects of the Proposed Scheme with the effects of other reasonably foreseeable developments ('committed 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.

4.8.2 The committed developments have been identified through consultation with BCC and ADVC include developments that are:

- approved and under construction (yet to be completed); and
- permitted application (s) but not yet implemented.

4.8.3 For the purposes of this ES, account has also been take of the following potential future developments:

- submitted application (s) not yet determined; and
- certain projects which are reasonably foreseeable and reasonably likely to come forward (i.e. they have a promoter, project team and/or funding) and for which sufficient information is available to assess the likelihood of cumulative effects.

4.8.4 A distance of 2km was used to identify the committed developments considered as part of this assessment. These are listed in Table 5 and shown on Map ES-08: Committed Developments in Volume 3: Environmental Statement Maps.

4.8.5 In addition, to those committed developments detailed in Table 5, are those accepted as part of the Future Baseline, discussed in Section 4.4, namely:

- HS2 Phase One; and
- the proposed EWR2 upgrade (construction in 2019, operational from 2022); and
- the restoration of Calvert landfills; and
- Greatmoor EfW facility.

4.8.6 Where cumulative effects of the committed developments and potential future developments listed in Table 5 are identified, the rationale for the effect is explained in each topic section.

Table 5: Committed developments

Application Reference	Map Reference (see Map ES-08)	Status/ Consent and Type of Application	Date of Decision	Easting, Northing	Local Authority/ Borough	Site Address	Ward	Site Area (Hectares)	Location in relation to alignment (Spatial scope)	Description of Development
16/00073/APP	GRS/1	Awaiting decision Full Planning Application	N/A	470819, 216243	AVDC	Westcott Venture Park High Street Westcott Buckinghamshire	Waddesdon	2.3	Approx. 1.5km from Greatmoor Railway Sidings (from southern tail end)	Creation of open storage to be used for the storage and maintenance of modular buildings with associated parking
15/00810/ALB	GRS/2	Consent granted Listed building	Mon 20 Jul 2015	470439, 222220	AVDC	Lower Greatmoor Farm Shipton Lee Quainton Buckinghamshire HP18 0QN	Grendon Underwood and Brill	Not specified	Boundary of Lower Greatmoor Farm within 100m of Proposed Scheme	Repairs/renewals to thatched and tiled roof areas including outbuilding. Repairs/partial re-building to chimney stacks. Replacement of windows, damp proofing works, relocation of existing oil tank and various external alterations.
15/01532/APP	GRS/3	Approved Full Planning Application	Mon 20 Jul 2015	470439, 222220	AVDC	Lower Greatmoor Farm Shipton Lee Quainton Buckinghamshire HP18 0QN	Grendon Underwood and Brill	Not specified	Boundary within 100m of Proposed Scheme	Relocation of existing oil tank.

Application Reference	Map Reference (see Map ES-08)	Status/ Consent and Type of Application	Date of Decision	Easting, Northing	Local Authority/ Borough	Site Address	Ward	Site Area (Hectares)	Location in relation to alignment (Spatial scope)	Description of Development
14/03577/APP	GRS/4	Approved Full Planning Application	Fri 13 Feb 2015	not specified	AVDC	Woodham Industrial Estate Bicester Road Woodham Buckinghamshire HP18 0QE	Grendon Underwood and Brill	0.82 hectares (Including Site Access), 0.29 hectares (Excluding Site Access- Concrete Batching Facility only)	Boundary within 100m of Proposed Scheme (of southern tail end of Proposed Scheme)	Installation and operation of a concrete batching plant with storage, parking facilities and access.

4.9 Significant residual effects

4.9.1 The ES is required to assess the potential for significant residual effects, i.e. any effects anticipated to remain following implementation of mitigation which are considered to be significant. The significance of residual effects is defined in accordance with the methodology set out by each topic assessment.

4.10 Assumptions

4.10.1 Third party information/data received for the purposes of this ES is assumed to be correct.

4.10.2 Assumptions that are discipline specific are referred to in the relevant ES sections.

5 Agriculture, forestry and soils

5.1 Introduction

5.1.1 This section provides a description of the current baseline for agriculture, forestry and soils and an assessment of the potential impacts and significant effects as a result of the construction and operation of the Proposed Scheme. Consideration is given to the extent and quality of the soil underpinning the primary agricultural land use and the physical and operational characteristics of holdings engaged in this activity.

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

5.1.3 Soil attributes, other than for food and biomass production, are identified in this section, however the resulting function or service provided is assessed in other sections, notably cultural heritage, ecology and landscape and visual assessment.

5.1.4 The main issue for rural holdings is the disruption of the Proposed Scheme to the physical structure of agricultural holdings and the operations taking place upon them, during both its construction and operational stages. Engagement was undertaken with the land users affected in 2012/2013 to obtain factual information on the scale and nature of the farm and related farm-based uses; this has been relied upon for this assessment.

5.2 Assessment methodology

Scope, assumptions and limitations

5.2.1 The assessment scope, key assumptions and limitations for the agriculture and soils assessment are as set out in the HS2 Phase One ES, Volume 5, the SMR and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

5.2.2 No commercial forestry will be affected by the Proposed Scheme and as such this topic is scoped out from any further assessment.

Surveys/source of information

5.2.3 A desk-based study was undertaken as part of the HS2 Phase One ES in 2012/2013 to establish the likely baseline soil and ALC of the site. The results of this study have been used for this assessment and further background information is provided in Volume 4.02: Environmental Statement Technical Appendix: Agriculture, forestry and soils impact assessment. A detailed soil and ALC field survey will be undertaken to inform soil handling and restoration after the TWAO is made.

5.2.4 As part of the HS2 Phase One ES, baseline surveys of farm holdings were also undertaken in 2012/2013 to assess the effect of the HS2 Phase One scheme on them. These findings remain valid for use in this assessment.

Study area

5.2.5 The study area comprises the agricultural land that is physically affected by the Proposed Scheme (to the east and west of the Aylesbury Link railway line). None of the land to the west of the existing railway that will be affected by the Proposed Scheme is in agricultural production; as it now forms part of the Greatmoor EfW facility restoration scheme.

5.3 Legislation and planning policy framework

Legislation

5.3.1 In 2006, the European Commission adopted a comprehensive 'Thematic Strategy for Soil Protection'[8] specifically dedicated to soil protection which included a proposal for a 'Soil Framework Directive'[9] to promote the sustainable use of soil and protect soil as a natural and non-renewable resource. However, the proposed Directive was withdrawn in April 2014. In reaching this decision the European Commission stated that it remains committed to the objective of the protection of soil and of examining options how best to achieve this.

5.3.2 No direct replacement proposals have yet come forward from the Commission, although Directive 2014/52/EU emphasises that public and private projects should consider and limit their impact on land take and on soil, including the loss of organic matter, erosion, compaction and sealing (i.e. covering undisturbed natural soils with urban and infrastructure development).

5.3.3 Thus, although there remains no specific UK legislation for the protection of soil and agricultural land, Defra issued the 'Soil Strategy for England – Safeguarding our Soils'[10] in 2009. The aims of the Strategy have been incorporated into the Natural Environment White Paper: The natural choice: securing the value of nature[11] and set out Defra's vision that by 2030 all England's soils will be managed sustainably and degradation threats tackled successfully in order to improve the quality of England's soils and safeguard their ability to provide essential services for future generations.

5.3.4 The Strategy sets out priorities for action in respect of:

- better protection of agricultural soils;
- protecting and enhancing stores of soil carbon;
- building the resilience of soils to a changing climate;
- preventing soil pollution;

[8] European Commission (EC), 2006, Soil Thematic Strategy (COM (2006) 231), EC
[9] European Commission (EC), 2006, Proposal for a Soil Framework Directive (COM (2006) 232), EC
[10] Department for Environment, Food and Rural Affairs (Defra), 2009, Safeguarding our Soils: A Strategy for England, Defra
[11] HM Government; 2011, The Natural Environment White Paper, The natural choice: securing the value of nature, The Stationery Office

- effective soil protection during construction and development; and
- dealing with the legacy of contaminated land.

Planning policy

5.3.5 The National Planning Policy Framework[12] (NPPF) indicates in Paragraph 112 that the economic and other benefits of BMV agricultural land should be taken into account in development decisions and that where significant development of agricultural land is demonstrated to be necessary, poorer quality land should be used in preference to higher quality land. There is no policy guidance with regard to the effects of development proposals on farm holdings although paragraph 28 emphasises the need to support economic growth in rural areas to create jobs and prosperity by, amongst other means, promoting the development and diversification of agricultural and other land-based rural businesses.

5.3.6 Similarly, although Natural England's Technical Information Note (TIN 049)[13] indicates that land quality is not the sole consideration as to how development proposals affect agricultural land, it no longer refers to 'other' relevant factors such as the impact on farm size and structure, the use of buildings and other fixed equipment, or any stimulus a development might give to rural economic activity. Instead, TIN 049 indicates that planning authorities should be guided by the NPPF to protect and enhance soils more widely, including for example conserving soil resources during construction and preventing soil from being adversely affected by pollution.

5.4 Environmental baseline

Existing baseline

Soils and land resources

Topography and drainage

5.4.1 The study area comprises mainly agricultural land which is characterised by shallow gradients and lies at an altitude of 70 to 80m Above Ordnance Datum (AOD). There are no gradient limitations on the agricultural use or quality of the land. The majority of the study area drains to the Muxwell Brook, which runs from east to west along the boundary of Sheephouse Wood SSSI.

Geology and soil parent materials

5.4.2 The main geological features are described in Section 10, Land quality. The bedrock geology underlying the study area consists of the Ancholme Group composed of a succession of different mudstones. The majority of the study area is underlain by the Stewartby Member, whereas the south eastern section of the study area is underlain by the Weymouth Member. Both are predominantly of silty clay material, but localised sands and gravels also occur.

[12] Department for Communities and Local Government (DCLG), 2012, National Planning Policy Framework, The Stationery Office
[13] Natural England (2012) Agricultural Land Classification: protecting the best and most versatile agricultural land (TIN049)

Description and distribution of soil types

5.4.3 According to published information (detailed in Volume 4.02: Environmental Statement Technical Appendix: Agriculture, forestry and soils impact assessment), the Denchworth association is mapped across the study area. This association overlies mudstones and typically comprises stoneless, slowly permeable, seasonally waterlogged clayey soils, with some fine loamy over clayey soils. They are typically waterlogged for long periods in winter and at times in the growing season and are poorly drained in Wetness Class (WC) IV[14].

Soil and land use interactions

Agricultural land quality

5.4.4 The principal soil/land use interaction in the study area is the quality of the agricultural land resource. The ALC is based on the identification of physical limitations to the agricultural capability of land resulting from the interactions of soil, climate and the site. The main soil properties which affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. In the absence of a detailed field survey, reliance has been placed upon published data which indicates that in the area of the Proposed Scheme the soils are predominantly poorly drained clayey soils.

5.4.5 Climate does not in itself place any limitation on land quality in this section and the area is moderately warm with an annual average rainfall of approximately 640mm per year. The average number of Field Capacity Days (FCD[15]) is 135 which is lower than the average for lowland England (150 days) and is favourable for providing opportunities for agricultural land work. Gradient and microrelief, with complex changes of slope angle or direction over short distances, are not considered to represent a limitation to the land.

5.4.6 The principal limiting factor determining agricultural land quality in this area is likely to be soil wetness. Denchworth soils, as mapped across the study area, are typically poorly drained in WC IV which, combined with mostly non-calcareous clay loam topsoils in this climatic regime, classifies them as Subgrade 3b (this finding will be subject to detailed field survey observations).

5.4.7 Department for Environment, Food and Rural Affairs (Defra) predictive mapping indicates that there is generally a low likelihood of encountering BMV land in this area which makes the presence of such land a resource of high sensitivity owing to its relative scarcity.

Other soil interactions

5.4.8 Soil fulfils a number of functions and services for society in addition to those of food and biomass production which are central to social, economic and environmental

[14] The Wetness Class (WC) of a soil is classified according to the depth and duration of waterlogging in the soil profile and has six categories from well drained WCI to very poorly drained WCVI.
[15] Field Capacity Day is a meteorological parameter which estimates the duration of the period when the soil moisture deficit is zero. Soils usually return to field capacity (zero deficit) during the autumn or early winter and the field capacity period, measured in days, ends in the spring when evapotranspiration exceeds rainfall and a moisture deficit begins to accumulate and opportunities for mechanised fieldwork are then possible.

sustainability. These are outlined in sources such as the Soil Strategy for England[16] and The Natural Choice: securing the value of nature[17] and include:

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

5.4.9 The shallow gradients within the study area do not place any significant limitations on the agricultural use of the land.

5.4.10 The floodplains and riparian zones of the Muxwell Brook represent the functional flood environments, as set out in Section 14, Water resources and flood risk with the soils functioning as water stores for flood attenuation, as well providing a habitat for ecology. According to the EA Flood Zone Map, the Proposed Scheme is located in Flood Zone 1, but adjacent to the flood zones of the Muxwell Brook (please refer to Volume 4.13: Environmental Statement Technical Appendix: Flood Risk Assessment for further details). It is not thought likely that flooding will affect the ALC of the land. The presence of soil-borne cultural assets is detailed in Section 8.

Land use

Land use description

5.4.11 The agricultural land affected by the Proposed Scheme has, in the past, been managed by a large dairy farm in Twyford (to the north). However, as the development of the Greatmoor EfW facility and the Calvert landfill site has continued so the long-term reliance on the availability of this land has reduced. The agricultural land in the study area is currently used for grazing or arable crops.

Number, type and size of holdings

5.4.12 There are four holdings affected by the Proposed Scheme as detailed below and shown on Map ES-09 Agricultural Land Quality and Holdings in Volume 3: Environmental Statement Maps. The references used to describe the holdings in the Hs2 Phase One ES have been used in this ES for consistency (e.g. "CFAXX/X").

5.4.13 To the east of the existing railway:

- Greatmoor and Shepherd's Furze Farms CFA13/2 (hereafter referred to as Portway Farm) comprises a large dairy farm at Twyford (approximately 7.0km to the north of the study area). In 2012 the farm extended to some 566ha with a dairy herd of 200 cows expected to rise to 400 cows. The Portway Farm

[16] Defra, (2009), *Soil Strategy for England.*
[17] Defra, (2011), *The Natural Choice: securing the value of nature.*

enterprise includes the land required for the Proposed Scheme which is owned by FCC, but currently rented under an Agricultural Holdings Act tenancy; and

- to the south, Finemere Wood nature reserve is owned by BBOWT and managed mainly for its biodiversity, rather than its agricultural potential (CFA12/17).

5.4.14 To the west of the existing railway two parcels of land are affected:

- Doddershall Estate (CFA12/10) owns extensive areas of woodland including Grendon Wood to the south-west of the Proposed Scheme; and
- Oak Tree Farm (CFA12/14) is a 51ha grassland beef cattle unit with a large diversified agricultural contracting business.

Future baseline

5.4.15 Other than the proposed HS2 Phase One scheme, no committed developments have been identified in this local area that will materially alter the baseline conditions in 2017 or 2019 for agriculture and soils. The EWR2 upgrade is expected to be undertaken entirely within the railway corridor and no additional agricultural land will be required.

5.5 Effects arising during construction

Avoidance and mitigation measures

5.5.1 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction.

5.5.2 The draft CoCP sets out a series of measures and standards that HS2 Ltd. and the contractors appointed to deliver the Proposed Scheme will be required to meet for the duration of the construction. It will also ensure that potential impacts on people and the natural environment are kept to a practicable minimum.

5.5.3 Of particular relevance to agriculture and soils will be:

- the provision of a method statement for stripping, handling, storage and replacement of soil to reduce risks associated with soil degradation on areas of land to be returned to agriculture or woodland/hedgerows following construction. This shall include any remediation measures necessary following completion of the whole of the works as part of a five year aftercare regime;
- permanently and temporarily displaced soils to be handled in accordance with the draft CoCP and Defra's Construction Code of Practice for the Sustainable Use of Soils and Construction Sites (2009) and their beneficial re-use wherever practicable;
- protecting agricultural land adjacent to the construction site, including provision and maintenance of appropriate fencing and avoidance of traffic over agricultural land leading to soil compaction;

- detailing farm accesses which may be affected by construction and agreeing the manner in which farm access shall be maintained;
- contractor liaison with farmers and their agents relating to the intended commencement of construction works in areas of the site adjacent to agricultural land and access routes to be used; and
- contractor to take precautions in developing the construction programme to reduce disturbance from construction works to neighbouring land users.

Assessment of impacts and effects

Impacts on agricultural land

5.5.4 Construction of the Proposed Scheme is not likely to affect BMV agricultural land.

5.5.5 During construction the total area of agricultural land used will be approximately 20.0ha of land likely to be classified as Subgrade 3b, based on the desk assessment of predicted land quality.

5.5.6 The permanent change of 20.0ha of moderate quality agricultural land to a non-agricultural use is assessed as an impact of low magnitude. The effect is not significant.

Nature of the soil to be disturbed

5.5.7 The sensitivity of the soils that will be disturbed by construction activity reflects their textural characteristics, in the light of local rainfall conditions. Soils with high clay and silt fractions in areas of heaviest rainfall are most susceptibility to the effects of handling during construction and the re-instatement of land; whereas soils with a high sand fraction in areas of lowest rainfall are the least susceptible.

5.5.8 Successful soil handling is dependent upon movements being undertaken under appropriate weather and ground conditions using the appropriate equipment. The principles of soil handling are well established and set out in advisory material such as the Construction Code of Practice for the Sustainable Use of Soils on Construction Sites (Defra, 2009) which will be followed throughout the construction period. The clay loam and clay topsoils of the Denchworth association are susceptible to compaction and smearing when moved in wet conditions or by inappropriate equipment and need particularly careful handling to avoid damage to soil structure if the permanently displaced soils are to be reused within the study area or elsewhere on the project.

5.5.9 The proposals will require the re-use of approximately 50,000m^3 of topsoil within the 14.0ha (140,000m^2) that will be restored for ecological and/or landscape mitigation at an approximate depth of 350mm.

5.5.10 Compliance with the draft CoCP will ensure the impact on soil is low. However, the high sensitivity of the soils could give rise to a moderate adverse effect if the works are not undertaken in an appropriate manner.

Impacts on holdings

5.5.11 Four holdings will be affected:

- Portway Farm (CFA13/2) will be significantly affected by the construction of the proposed HS2 Phase One scheme with the removal of some 143.3ha of arable and grass land during construction (25% of the total area farmed) and the permanent removal of 77.4ha (14%). A further 19.0ha of arable and grass land will be required for the Proposed Scheme. No grazing land is required for the dairy operation of Portway Farm, and as such it will not be affected. The long-term continuation of dairy farming should still be possible on the residual land;
- Finemere Wood nature reserve (CFA12/17) will lose less than 1.0ha of grassland. This will not affect the long-term viability of the holding (the impact on ecology and the landscape value of this nature reserve is assessed elsewhere in this ES);
- Doddershall Estate (Grendon Wood) will lose less than 0.1ha and this will not affect the viability of the holding; and
- Oak Tree Farm will lose less than 0.1ha and this will not affect the long-term viability of the holding.

5.5.12 In total some 20.0ha of agricultural land is required permanently for the construction of the Proposed Scheme with the majority of that land being farmed by Portway Farm. Approximately 14.0ha will be restored for ecological and/or landscape mitigation with the remaining 6.0ha for operational development.

5.5.13 Overall, the construction effect of the Proposed Scheme (and the permanent removal of 20.0ha of agricultural land to built form or landscape/ecological mitigation) would have a negligible effect on Portway Farm, but as the Proposed Scheme is situated adjacent to the HS2 Phase One scheme, it increases the major significant effect that the construction of HS2 will have on the holding.

5.5.14 Due to the limited area of land required from the other holdings (and no severance) the construction effects on Finemere Wood nature reserve, Doddershall Estate and Oak Tree Farm will be negligible.

Cumulative effects

5.5.15 The construction of the proposed HS2 Phase One scheme is the most significant development proposed for the area and overall will result in a significant loss of BMV agricultural land. However, the construction of the Proposed Scheme will not affect BMV agricultural land and therefore there are no cumulative effects to assess with regards to that resource.

5.5.16 The loss of agricultural land due to the Proposed Scheme will have a negligible contribution to the amount of agricultural land lost as a result of the proposed HS2 Phase One scheme.

5.5.17 The effect on the holdings affected is reported above.

Other mitigation measures

5.5.18 Soil permanently displaced during construction of the Proposed Scheme will so far as reasonably practicable, be reused locally as part of the proposed woodland and ecological planting, and for engineering earthworks and green bridges. Specialist

landscape management staff with the specific responsibility for monitoring and supervising works in relation to topsoil and subsoil stripping, storage and replacement will be retained to ensure the appropriate reuse of soil.

Summary of likely significant residual effects

5.5.19 BMV agricultural land is not likely to be affected by the Proposed Scheme.

5.5.20 The Proposed Scheme will not give rise to any significant residual effects on agricultural or soil resources. However, as the Proposed Scheme is part of the wider development of HS2 Phase One, it should be noted that two holdings (Portway Farm and Doddershall Estate) are already significantly affected by the construction of the HS2 Phase One scheme. The Proposed Scheme compounds that effect on Portway Farm.

5.5.21 Finemere Wood nature reserve and Oak Tree Farm are not significantly affected.

5.6 Effects arising from operation

5.6.1 Insofar as the Proposed Scheme is simply a relocation of an existing facility that operates close to agricultural land it is not considered that there will be any significant impacts on agriculture or soil arising from the operation of the Proposed Scheme.

6 Air quality

6.1 Introduction

6.1.1 This section sets out the assessment of impacts to air quality as a result of the construction and operation of the Proposed Scheme. Consideration is also made of the cumulative changes in baseline air quality associated with the operation of the Greatmoor EfW facility and the upgrading of the Aylesbury Link railway line to passenger services and the upgrading of the FCC waste haulage fleet.

6.2 Assessment methodology

Scope, assumptions and limitations

6.2.1 This air quality assessment considers changes to local air quality as a result of the relocation of the existing railway sidings to a location further south.

6.2.2 The proposed relocation will result in changes to emissions and impact at receptors due to a number of factors, including: emissions from diesel rail locomotives, changes in traffic flows on public highways and changes in traffic flows associated with the operations of the Proposed Scheme. These have been assessed as they are considered to have the potential to result in new or different likely significant effects on air quality.

6.2.3 Receptors close to the existing sidings, including people in Calvert village and the northern end of Sheephouse Wood SSSI, currently experience air quality affected by the emissions from HGVs and diesel trains. The baseline air quality at sensitive human receptors is currently well within air quality standards. However, critical loads for nutrient nitrogen are currently exceeded at Sheephouse Wood SSSI.

6.2.4 An assessment of these existing impacts has been not been undertaken, and so the improvement in air quality at these receptors due to the relocation of the sidings has not been quantified. Due to the separation distance between the existing railway sidings and the location of the Proposed Scheme, the current sidings operations are not anticipated to significantly affect baseline air quality at the receptors close to the proposed new sidings. However, the assessment does take into consideration the impacts of existing waste haulage activities from the sidings to Calvert landfill and the Greatmoor EfW facility, as these will change with the operations of the Proposed Scheme.

Methodology, data sources and design criteria

6.2.5 The main assessment methodology, key assumptions and limitations for air quality are set out in the HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

6.2.6 Assessment of the effects of emissions arising from changes to traffic flows on the public highway during both the construction and operational stages of the Proposed Scheme is limited to receptors located along roads that meet any of the criteria specified in the Design Manual for Roads and Bridges (DMRB). These criteria are as follows:

- road alignment change by 5m or more;
- daily traffic flows change by 1000 annual average daily traffic (AADT) or more;
- heavy duty vehicle flows change by 200 AADT or more;
- daily average traffic speed changes by 10kph or more; or
- peak hour traffic speed changes by 20kph or more.

6.2.7 Following this screening process, in the case of sensitive human receptors a more detailed screening using the DMRB methodology is applied and where potentially significant impacts are identified detailed dispersion modelling is undertaken. In terms of sensitive ecological receptors, the DMRB screening stage is skipped and detailed dispersion modelling is undertaken as the next step.

6.2.8 In terms of assessing impacts on air quality due to the relocation of the sidings themselves a more detailed approach has been adopted, to take into account the changes in emissions sources. There are changes to the baseline, impacts during the construction phase and impacts during the operational phase. The baseline conditions at the receptors derived from Department for Environment, Food and Rural Affairs (Defra) maps[18]and the UK Air Pollution Information System (APIS) reflect an essentially undeveloped environment, with fewer emissions sources, including emissions associated with the historical use of the Calvert landfill. However, the Greatmoor EfW facility is now operational and by 2022 the Aylesbury Link railway line will be upgraded and have additional passenger services introduced. Therefore it is necessary to calculate the future baseline which is affected by emissions from the Greatmoor EfW facility directly, and the associated traffic accessing the Greatmoor EfW facility and the Aylesbury Link railway line. Since the completion of the Greatmoor EfW facility, the routes of the waste haulage vehicles from the existing railway sidings has changed. These waste HGVs currently travel from the existing sidings to the Greatmoor EfW facility, rather than to the Calvert landfill as was previously the case. Within this assessment, the impact on the future baseline is identified and future impacts associated with the construction and operation of the Proposed Scheme are identified:

- the baseline and future baseline will be affected by emissions from the Greatmoor EfW facility. Emissions arise from the facility itself, and also from waste trucks accessing the facility from the A41 along Greatmoor Road. Formerly, waste haulage vehicles accessed Calvert landfill site from the north through Calvert village, access which has now been permanently closed;
- the future baseline will be affected by the change in location of emissions from the waste haulage vehicles [19]. These haulage vehicles previously transferred waste from the existing railway sidings to the Calvert landfill site but now transfer waste to the Greatmoor EfW facility, rather than Calvert landfill;

[18] Department for Environment, Food and Rural Affairs (Defra) (20162012) *Defra Background Pollutant Concentration Maps*; http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html; Accessed: July 2016

[19] FCC use off-road dumper trucks to transport waste from the sidings. Previously these took waste to the landfill, and now take waste to the Greatmoor EfW facility.

- the future baseline and operational phase will be affected by the upgrade to the Aylesbury Link railway line, with new diesel powered passenger services being introduced. Currently the line is used by diesel freight traffic primarily accessing the existing railway sidings;
- during the construction phase of the Proposed Scheme there will be emissions generated by construction traffic, principally related to the construction of the sidings element of the Proposed Scheme. This will arise on the HS2 Phase One trace, and on local roads including Station Road and the A41;
- during the operational phase of the Proposed Scheme there will be a change in the location of the emissions from the diesel powered locomotives on the trains, using the Proposed Scheme operational sidings. Currently these emissions do not exist in the location of the Proposed Scheme, as the existing railway sidings are further north. The total number of freight movements will not change;
- the use of the sidings element of the Proposed Scheme generates traffic in the form of spoil trucks[20] taking spoil waste from trains to the Calvert landfill and waste HGVs taking municipal solid waste from the Proposed Scheme to the Greatmoor EfW facility. This traffic is currently generated at the location of the existing sidings to the south of Calvert, and in the operational case this traffic will instead be generated to at the location of the Proposed Scheme; and
- FCC will be renewing its spoil haul fleet in September 2016. The use of these new vehicles has been incorporated into the assessment. In addition, FCC will, prior to operation of the Proposed Scheme (through the application of controls via a planning condition), either renew the fleet of waste haulage vehicles used to haul municipal solid waste to the Greatmoor EfW facility, or cease these activities. The assessment of the operational phase of the Proposed Scheme is based on the use by FCC of its existing waste haulage vehicles; however the assessment of the operational phase including other mitigation measures includes the use by FCC of road going HGVs compliant with, at minimum, EURO V[21] emission standards in the place of its current fleet of waste haulage vehicles. This future operational scenario therefore represents a situation with lower NOx emissions, as a result of the use of newer vehicles.

6.2.9 This assessment therefore requires an approach which departs from the SMR whereby the future baseline air quality is calculated from new sources of emissions, and the construction and operational phase impacts are calculated in the context of the future baseline. These assessments use dispersion modelling, based upon information from: the FCC Environmental Permit; the operation of the Proposed Scheme sidings; the current operations of the waste sidings; the current and future operations of the Aylesbury Link railway line; the Traffic Assessment (refer to Section 13, Traffic and Transport) and current haulage operations.

[20] FCC use off-road dumper trucks to transport waste from the sidings to the landfill.
[21] Euro V engines are required to have lower emissions of NO_x and particulate matter than older engines.

6.2.10 Dispersion modelling was then undertaken to changes in air quality at receptors from both the construction phase where construction traffic from the construction of HS2 Phase One is also present in the area, and the operational phase where the impacts are changed due to the relocation of the sidings.

6.2.11 Assessment was undertaken of the operations of the Proposed Scheme using ADMS – Roads. This model can consider road sources, line sources (rail lines) and industrial point sources (the Greatmoor EfW facility). The assessment considered emissions from: diesel rail locomotives on the Aylesbury Link railway line; rail locomotives using the sidings; traffic associated with the operation of the Greatmoor EfW facility; traffic from the sidings to Calvert landfill; and the operation of the Greatmoor EfW facility. The assessment also considered impacts on sensitive ecological receptors and sensitive human receptors.

Surveys/source of information

6.2.12 No surveys specifically for air quality were undertaken for this assessment. Information on construction and operational traffic was obtained from the Traffic Assessment (refer to Section 13, Traffic and Transport).

Study area

6.2.13 The study area comprises an area of approximately 500m around the sidings, access roads, Greatmoor EfW facility, and highways including the A41 and Station Road. This study area ensures that impacts are captured within the context of the changing baseline, and given that the sources are not all roads.

6.3 Legislation and planning policy framework

Legislation and Guidance

6.3.1 The legislation and guidance framework used in the assessment is set out in HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

6.3.2 The draft AVDC Local Plan for consultation[22] contain policies specific to air quality. Policy NE5 discusses the potential impact of emissions of nitrogen oxides on wildlife sites, and again stipulates that any scheme potentially impacting such sites will require an air quality impact assessment. This is relevant in this case, due to the proximity of the development to four SSSI and two local nature reserves.

Air Quality Standards

6.3.3 The relevant air quality standards are for NO_2 and particulate matter as PM_{10} which are as follows:

- 40µg/m^3 as an annual mean for NO_2 and PM_{10};
- 200µg/m^3 one-hour mean for NO_2 not to be exceeded more than 18 times a

[22] Aylesbury Vale District Council (2016) *Draft Plan for Summer 2016 Consultation.*

year (equivalent to the 99.8th percentile of the one-hour mean); and

- 50µg/m^3 24-hour mean for PM_{10} not to be exceeded more than 35 times a year (equivalent to the 90.4th percentile of the 24-hour mean).

6.3.4 In addition, there are critical levels and critical loads for the SSSIs which are obtained from the APIS website. These are:

- NOx 30µg/m^3 as an annual mean; and
- Nutrient nitrogen deposition: 15 – 20 kgN/ha/yr.

6.4 Environmental baseline

Existing air quality

Local authority review and assessment information

6.4.1 AVDC carries out monitoring across its district. As part of its review and assessment process, AVDC has identified a number of areas in its district that may not be compliant with air quality standards; these are Air Quality Management Areas (AQMAs). There are no AQMAs within the study area.

Local air quality monitoring data

Continuous monitoring

6.4.2 There are no continuous monitors within the study area that are relevant to this assessment.

Diffusion tubes

6.4.3 There are no diffusion tubes within the study area that are relevant to this assessment.

Existing and future background air quality

Background pollutant concentrations

6.4.4 Estimates of background air quality have been taken from Defra maps[23]. Background NO_2 concentrations are within air quality standards throughout the study area, with annual mean concentrations in the range 8.4µg/m^3 – 8.5µg/m^3 in 2016. However, as noted, the existing baseline from the Defra mapping does not reflect the recent changes to the baseline associated with the operation of the Greatmoor EfW facility and does not reflect the future changes to the baseline associated with the upgrading of the Aylesbury Link railway line. Modelling has been undertaken to identify the changes to the future baseline, as a result of new sources in the vicinity of the Proposed Scheme.

[23] Department for Environment, Food and Rural Affairs (Defra) (20162012) *Defra Background Pollutant Concentration Maps*; http://laqm.defra.gov.uk/review-and-assessment/tools/background-maps.html; Accessed: July 20162013

Local emission sources

6.4.5 The main existing source of pollution in the study area is road vehicles, and associated with the activity of the Calvert landfill site. There is little other industry and some emissions from residential areas. There are no major roads in the study area likely to impact on baseline air quality, noting that traffic on the A41 will impact receptors only in close proximity to the roadside.

6.4.6 The emissions from the Greatmoor EfW facility will be captured in the future baseline assessment.

Receptors

6.4.7 Within the study area there are human and ecological sensitive receptors. These are:

- Human receptors:
  - Crossroads Farm (Station Road);
  - Lower Greatmoor Farm, Woodlands Farm, Oak Tree Farm and Moor Farm (in proximity of the Proposed Scheme); and
- Ecological receptors:
  - Ham Home-cum-Hamgreen Woods SSSI (A41); and
  - Sheephouse Wood SSSI, Finemere Wood SSSI, Grendon and Doddershall Woods SSSI, Hewins Wood and a track leading to the Aylesbury Link railway line NLR reserve (in proximity of the Proposed Scheme), and Ham Home and Hamgreen Woods SSSI (in proximity of the A41).

6.4.8 The existing baseline nutrient nitrogen deposition at the ecological receptors are:

- Ham Home-cum-Hamgreen Woods SSSI: 32.8 kg N ha^{-1} $year^{-1}$;
- Sheephouse Wood SSSI: 35.1 kg N ha^{-1} $year^{-1}$;
- Finemere Wood SSSI: 30.5 kg N ha^{-1} $year^{-1}$; and
- Grendon and Doddershall Woods SSSI: 35.1 kg N ha^{-1} $year^{-1}$.

6.5 Effects arising during construction

Avoidance and mitigation measures

6.5.1 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.13: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction. No other site specific mitigation measures are proposed.

Assessment of impacts and effects

Temporary effects - dust

6.5.2 The following sections provide details of the assessment of construction impacts following the Institute of Air Quality Management (IAQM) guidance[24]. Where considered useful to identify receptors and their relationship to the construction activity, a specific figure is provided. On-site haul movements were assessed explicitly.

6.5.3 The dust assessment criteria for the Proposed Scheme are based on those for earthworks, as set out in the IAQM guidance. This emission phase was considered to be the most applicable, as the assessment of impacts from earthworks will depend, in part, on the passage of vehicles over unmade surfaces. It was assumed that significant effects would not occur beyond a distance of 50m from the sidings construction activities, again based on interpretation of the earthworks criteria, and that all areas of the sidings works will be subject to more than 10 vehicle movements per day. On the basis of criteria for earthworks within the IAQM guidance, the dust emission class for the haul route is large. Wherever there are receptors within 50m of the sidings, the sensitivity of the receiving environment was derived using the IAQM guidance.

6.5.4 The need for, and capability of, the draft CoCP to control these dust emissions locally, was considered in forming the conclusion of this assessment.

6.5.5 The assessment of dust impacts is set out in detail in Volume 4.03: Environmental Statement Technical Appendix: Air quality impact assessment.

6.5.6 The assessment concluded that with the implementation of the draft CoCP there will be negligible impacts at sensitive human and ecological receptors.

Temporary effects - traffic

6.5.7 Screening using the DMRB method was undertaken for construction phase traffic. Following this process, potentially significant increases in traffic on the public highway were identified on Station Road. Impacts were assessed using the DMRB methodology at Crossroads Farm, the nearest sensitive receptor to the roadside. Assessment was also undertaken using dispersion modelling of the impacts of traffic on the A41 on Ham Home cum Hamgreen Woods SSSI as this habitat is in close proximity to the roadside.

6.5.8 Assessment was also made of impacts on sensitive human receptors and sensitive ecological receptors within the study area around the sidings. Impacts associated with construction traffic accessing the site using the on trace haul road have been considered, as there is the potential for significant impacts when considered alongside changes in the existing baseline due to the emissions from the Greatmoor EfW facility, and the associated traffic.

6.5.9 For sensitive human receptors identified next to roads meeting the DMRB criteria for assessment there are negligible impacts; there are also negligible impacts associated

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

with HS2 Phase One construction traffic on the HS2 Phase One trace. For sensitive ecological receptors there are potentially significant impacts within the first 10m of the Ham Home cum Hamgreen Woods SSSI, and negligible impacts at greater distances; there are negligible impacts at sensitive ecological receptors due to construction traffic on trace.

Permanent effects

6.5.10 There are no permanent affects related to air quality associated with the construction phase.

Cumulative effects

6.5.11 The principal cumulative effects are that there is additional traffic growth generated on the A41. These vehicles are taken into consideration in the assessment. The other changes to the baseline discussed previously are not a consideration for the construction phase, due to the separation distance between the sensitive receptors on Station Road and the A41 and these activities.

6.5.12 Other traffic associated with approved and committed schemes likely to generate vehicle movements during the construction phase are captured within the traffic data used within the assessment of the Proposed Scheme.

Other mitigation measures

6.5.13 In terms of sensitive human receptors, no mitigation is required. In terms of sensitive ecological receptors, potentially significant impacts have been identified. However, impacts on ecological receptors tend to occur over many years, and the temporary nature of the impacts relating to the construction phase is not considered likely to have a significant effect on ecological receptors.

Summary of likely significant residual effects

6.5.14 There are no likely significant residual effects during construction of the Proposed Scheme.

6.6 Effects arising from operation

Avoidance and mitigation measures

6.6.1 Through the application of controls via a planning condition, FCC will renew its fleet of waste haulage vehicles to newer vehicles which have lower emissions of NOx.

Assessment of impacts and effects

Temporary effects

6.6.2 There are no temporary effects on air quality for human receptors.

6.6.3 With the renewal of the waste haulage vehicles with engines have significantly lower emissions of NOx, there will be no temporary effects from the operation of the Proposed Scheme.

Permanent effects

6.6.4 For human receptors identified in the study area there are slight or negligible impacts, and no significant effects.

6.6.5 There are potentially significant impacts on Sheephouse Wood SSSI, which could lead to a significant effect on this habitat.

6.6.6 However, the existing waste haulage vehicles truck vehicle fleet will either be renewed for lower emission vehicles or will cease to operate through the application of controls via a planning condition. As the assessment of effects presented in Section 9, Ecology sets out, the associated reduction in emissions will remove the potentially significant effect on Sheephouse Wood SSSI.

Cumulative effects

6.6.7 On the basis of the assessment undertaken, there are no potentially significant cumulative impacts, or therefore effects, identified.

Other mitigation measures

6.6.8 No other mitigation measures are required.

Summary of likely significant residual effects

6.6.9 There are no likely significant residual effects on human or ecological receptors.

7 Community

7.1 Introduction

7.1.1 This section sets out the assessment of impacts to the community as a result of the construction and operation of the Proposed Scheme. It sets out the approach for and assessment of likely significant effects of the Proposed Scheme on community receptors and resources.

7.2 Assessment methodology

Scope, assumptions and limitations

7.2.1 The assessment scope, key assumptions and limitations for the community assessment are set out in the HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

Surveys/source of information

7.2.2 Surveys are not required for the community assessment. The information used for the community assessment is principally drawn from other environmental topics within this report (air quality; landscape and visual; sound, noise and vibration; and traffic and transport). The findings of these disciplines in terms of significant effects inform the community assessment.

Study area

7.2.3 The study area is defined as 1km from the boundary of the Proposed Scheme; this includes a 250m buffer zone from the land required for the construction of the Proposed Scheme. This geographical area of study is considered good practice in rural areas and was used within the HS2 Phase One ES.

7.2.4 In addition, the study area has regard to the proposed routing of construction traffic.

Community resources and receptors

7.2.5 The study area includes approximately 15 residential properties, which are the principal community receptors.

7.2.6 There is one community resource within the study area, which is Finemere Wood nature reserve. Part of the nature reserve is designated as a SSSI. Finemere Wood SSSI is located approximately 170m from the reception sidings and approximately 600m from the operational sidings of the Proposed Scheme.

7.2.7 The wider area of Finemere Wood nature reserve is owned and managed by BBOWT as a private reserve but is not subject to formal designation as a nature reserve e.g. Local or National Nature Reserve.

7.2.8 There are no other community facilities or recreational (promoted) PRoW in the study area.

7.3 Legislation and planning policy framework

7.3.1 No specific legislation or guidance exists in relation to the assessment of community impacts. However, the assessment has been undertaken with due regard and reference to the key national (UK and England); sub-national (regional or county-wide); and local (district or unitary authority level) socio-economic and community policy documents.

7.4 Environmental baseline

Existing baseline

7.4.1 The study area is rural in nature. There are approximately 15 residential properties, mostly scattered to the west of the Aylesbury Link railway line. PRoW intersect the study area, but these are not recreational (promoted) PRoW and therefore are considered to be out of the scope for the community assessment.

7.4.2 The nearest residential settlements are the village of Calvert (to the north), and the village of Edgcott (to the west), which are both just under 2km from the Proposed Scheme.

7.4.3 Finemere Wood SSSI and nature reserve is located to the south east of the study area. It is approximately 48ha in size, open to the public at all times and is mostly used for wildlife walks, with guided walks occasionally provided by BBOWT.

Future baseline

Construction

7.4.4 Section 4.8 (Cumulative effects) provides details of the developments which are assumed to have been implemented by 2019. No committed or potential future developments have been identified in this area that will materially alter the baseline conditions for the community.

Operation

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

7.5 Effects arising from construction

Avoidance and mitigation measures

7.5.1 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction.

Assessment of impacts and effects

Residential properties

7.5.2 The assessment has not identified any temporary or permanent effects for residential properties during the construction phase. Whilst significant effects have been identified within the landscape and visual and traffic and transport topics, combined

effects will not be experienced by enough residential properties in order to constitute a community effect.

Community resources

7.5.3 The construction of the reception sidings of the Proposed Scheme will occupy approximately 0.2ha of grassland along the south-western margin of BBOWT's Finemere Wood Nature reserve. This represents approximately 0.4% of the total area of the nature reserve. Given the small amount of land lost, the operation and use of the nature reserve would not be disrupted. Therefore, the effect is considered negligible and not significant.

7.5.4 There are no further effects for community resources in the study area.

Cumulative effects

7.5.5 No cumulative effects have been identified in the community assessment for the construction phase.

Other mitigation measures

7.5.6 No other mitigation measures are required

Summary of likely significant residual effects

7.5.7 There will be no significant residual effects during construction.

7.6 Effects arising from operation

Assessment of impacts and effects

Residential properties

7.6.1 The assessment has not identified any temporary or permanent effects for residential properties during the operation phase. Whilst significant effects for residential properties have been identified by the landscape and visual topic, these effects will not coincide with significant effects reported for other topics. As such, residential amenity will not be affected.

Community resources

7.6.2 The assessment has not identified any temporary or permanent effects for community resources during the operation phase.

Cumulative effects

7.6.3 No cumulative effects have been identified in the community assessment for the operation phase.

Other mitigation measures

7.6.4 No other mitigation measures are required.

Summary of likely significant residual effects

7.6.5 There will be no significant residual effects during operation.

8 Cultural heritage

8.1 Introduction

8.1.1 This section of the report provides a description of the current baseline for heritage assets and reports the likely impacts and significant effects resulting from the construction and operation of the Proposed Scheme. Consideration has been given to the extent and heritage value (significance) of assets including archaeological and palaeo-environmental remains, historic buildings and the built environment and historic landscapes.

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

8.1.3 Maps ES-11: Heritage Assets within Study Area, ES-12: Designated Heritage Assets, ES-13: Archaeological Character Sub-zones and ES-14: Remote Sensing Survey results can be found in Volume 3: Environmental Statement Maps.

8.1.4 Detailed reports on the cultural heritage character and surveys undertaken within the study area are contained within Volume 4: Environmental Statement Technical Appendices. These include:

- Volume 4.04: Environmental Statement Technical Appendix: Cultural heritage baseline report;
- Volume 4.05: Environmental Statement Technical Appendix: Gazetteer of heritage assets;
- Volume 4.06: Environmental Statement Technical Appendix: Cultural heritage impact assessment; and
- Volume 4.07: Environmental Statement Technical Appendix: Cultural heritage remote sensing survey summary.

8.1.5 Throughout this section, assets within the study areas are identified with a unique reference code, i.e. GRS001. In addition, assets within the study area that have been identified unique reference code, i.e. L36. Further detail on these assets can be found in Volume 4.05: Environmental Statement Technical Appendix: Gazetteer of heritage assets.

8.2 Assessment methodology

Scope, assumptions and limitations

8.2.1 The assessment scope, key assumptions and limitations for the cultural heritage assessment are as set out in the HS2 Phase One ES Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

8.2.2 The assessment has also taken account of the draft guidance on heritage impact assessments for Cultural World Heritage Sites (International Council on Monuments

and Sites), and a range of guidance from Historic England, the Chartered Institute for Archaeologists and BCC.

8.2.3 The setting of all designated heritage assets lying within 2km of the Proposed Scheme has been considered.

8.2.4 The study area within which a detailed assessment of all assets, designated and non-designated, has been carried out, is defined as the land required, temporarily and permanently, to construct the Proposed Scheme plus 500m.

8.2.5 The cultural heritage methodology includes the consideration of the intra-project effects of a number of technical topic assessments, for example, landscape and visual, ecology and water resources and flood risk. Consequently, these interactions have been included in the assessment of impacts and effects.

8.2.6 A limited amount of archaeological survey and investigation has previously been undertaken within the study area. As such professional judgement has been used to identify the archaeological potential of the study area.

Surveys/source of information

8.2.7 Information about heritage assets has been obtained from a range of sources, including registers of designated historic assets held by Historic England (formerly English Heritage), the BCC Historic Environment Record, historic landscape character mapping, conservation area appraisals, historic maps and aerial photography, LiDAR and site reconnaissance visits. A full list of the sources consulted can be found in the Volume 4: Environmental Statement Technical Appendices.

8.2.8 An aerial photograph and LiDAR assessment was undertaken as part the HS2 Phase One ES[25],[26] and a programme of heritage assessment and archaeological investigation was undertaken as part of the Greatmoor EfW facility planning application[27,28].

8.3 Legislation and planning policy framework

8.3.1 The overarching legislation in relation to the historic environment in England and Wales is provided by:

- the Ancient Monuments and Archaeological Areas Act 1979; and
- the Planning (Listed Buildings and Conservation Areas) Act 1990.

8.3.2 The NPPF provides additional guidance and addresses the conservation and enhancement of the historic environment. The relevant policies are:

- paragraph 128 notes that: In determining applications, local planning authorities should require an applicant to describe the significance of any

[25] http://webarchive.nationalarchives.gov.uk/20140806173413/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/cultural-heritage/Vol5_CFA12_Cultural_heritage_Survey_reports_CH-004-012.pdf
[26] http://webarchive.nationalarchives.gov.uk/20140806173413/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/cultural-heritage/Vol5_CFA13_Cultural_heritage_Survey_reports_CH-004-013.pdf
[27] SLR (2011) Greatmoor EfW, Calvert, Buckinghamshire, Heritage Impact Assessment; Lower Greatmoor Farm and Finemerehill House
[28] APS (2011) Land at Calvert/Greatmoor Buckinghamshire: Geophysical Survey unpublished report 109/11, and APS (2011b) Archaeological Evaluation of Land at Calvert in Charndon and Greatmoor in Grendon Underwood, Buckinghamshire

heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance.

- paragraph 131 asks local planning authorities to take account of three factors, namely:
  - the desirability of sustaining and enhancing the significance of heritage assets and putting them to viable uses consistent with their conservation;
  - the positive contribution that conservation of heritage assets can make to sustainable communities including their economic viability; and
  - the desirability of new development making a positive contribution to local character and distinctiveness.
- paragraphs 133 and 134 of the NPPF address the levels of harm that could be caused by development:
  - where a proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal, including securing its optimum viable use;
  - where a proposal will lead to substantial harm to or loss of significance of a designated heritage asset, local planning authorities should refuse consent, unless it can be demonstrated that the substantial harm or loss is necessary to achieve substantial public benefits that outweigh the harm of loss;
  - where a proposal will lead to less than substantial harm to the significance of a designated heritage asset, this harm should be weighed against the public benefits of the proposal, including securing its optimum viable use; and
  - where a proposal will lead to substantial harm to or loss of significance of a designated heritage asset, local planning authorities should refuse consent, unless it can be demonstrated that the substantial harm or loss is necessary to achieve substantial public benefits that outweigh the harm of loss.
- paragraph 137, the NPPF requires local authorities to look for opportunities for new development within world heritage sites, conservation areas and within the setting of designated assets to enable their significance to be enhanced or better revealed. It also encourages developments which preserve elements of setting which positively contribute to significance to be treated favourably.

8.3.3 The Buckinghamshire Minerals and Waste Core Strategy (November 2012) includes the following relevant policies in relation to cultural heritage assets:

- Policy CS18 Protection of Environmental Assets of National Importance;
  - Planning permission will not be granted for minerals and waste development that would lead to significant adverse effects on designated heritage assets, except where the harm is outweighed by the environmental, economic and social benefits of the development.

- Policy CS19 Protection of Environmental Assets of Local Importance;
  - Planning permission will not be granted for minerals and waste development that adversely affects locally important heritage assets, except where that it has been identified that the impact will be minimised and adequately mitigated for or appropriate compensation measures are in place.

8.3.4 Currently the relevant planning policies for AVDC are contained in the saved policies of the Local Plan (January 2004). The relevant policy for the historic environment is General Policy 59. Preservation of Archaeology Remains.

- This policy states that where research suggests that historic remains may be present on a development site planning applications should be supported by details of an archaeological field evaluation. In such cases the Council will expect proposals to preserve the historic interest without substantial change; and
- Where permission is granted for development involving sites containing archaeological remains the Council will impose conditions or seek planning obligations to secure the excavation and recording of the remains and publication of the results.

8.3.5 The draft Aylesbury Local Plan (2016) contains policy BE1 Heritage Assets. This policy sets out the local authority requirements for heritage assessment where a development is likely to affect a heritage asset and that the level of assessment will be dependent on the nature of the asset and/or the nature of the development.

8.3.6 The policy also indicates that where historic remains may be present on a development site planning applications should be supported by details of an archaeological field evaluation. In such cases the council will expect proposals to preserve the historic interest without substantial change.

8.3.7 Where permission is granted for development involving sites containing archaeological remains the council will impose conditions or seek planning obligations to secure the excavation and recording of the remains and publication of the results.

8.4 Environmental baseline

Existing baseline

8.4.1 In compiling this assessment, documentary baseline data was collected from a variety of sources as set out in Volume 4.04: Environmental Statement Technical Appendix: Cultural heritage baseline report.

8.4.2 In addition to the collation of the baseline data the following surveys have been undertaken:

- walkover and site reconnaissance from areas of public access or in locations where access was granted. This was undertaken to understand the character and form of heritage assets and the historic landscape, to review the setting of assets and to identify previously unknown assets; and
- a review of the remote sensing assessment for the HS2 Phase One ES.

Designated Assets

8.4.3 There are no scheduled monuments, registered parks and gardens, listed building, conservation areas or registered battlefield located wholly or partly within the land required for the Proposed Scheme.

8.4.4 An assessment was undertaken of all designated assets located within the wider 2km study area. The details on the identified designated assets within the study area can be found in Volume 4.05: Environmental Statement Technical Appendix: Gazetteer of heritage assets. The assessment of impacts on these assets can be found in Volume 4.06: Environmental Statement Technical Appendix: Cultural heritage impact assessment. These are summarised below.

8.4.5 There is one Grade II* listed building located within the 2km study area. Doddershall House (GRS002), located 1.8km to the south of the land required for the Proposed Scheme.

8.4.6 There are a seven Grade II listed buildings located within the wider study area of which two are located within 500m of the Proposed Scheme. These comprise:

- Finemerehill House (GRS001), is located approximately 140m to the east of the land required for the Proposed Scheme; and
- Lower Greatmoor Farm (GRS003) located approximately 90m to the west of the land required for the Proposed Scheme.

8.4.7 There are 10 areas of ancient woodland located within the 2km study area of which six are located within 500m of the Proposed Scheme. These comprise;

- Hewin's Wood (GRS029), located 400m to the west of the land required for the Proposed Scheme;
- Finemere Wood (GRS031), is located approximately 170m east of the reception sidings and approximately 600m south east of the operational sidings of the Proposed Scheme;
- Balmore Wood (GRS032), located 460m to the east of the and required for the Proposed Scheme;
- Romer Wood (GRS033) and Greatsea Wood (GRS034), located approximately 30m north of the land required for the Proposed Scheme; and
- Sheephouse Wood (GRS035), located approximately 30m north of operational sidings of the Proposed Scheme.

Non Designated Assets

8.4.8 The following non-designated assets of moderate value lie wholly or partially within the land required, temporarily or permanently, for construction of the Proposed Scheme (see Map ES-11: Heritage Assets within Study Area, in Volume 3 of this ES). These comprise:

- cropmark evidence for medieval/post medieval ridge and furrow (L33, L34, L36, L38, L39 and L41 (see Volume 4.07: Environmental Statement Technical Appendix: Cultural heritage remote sensing survey summary));

- the route of the Great Central Railway (GRS019) (now used as a freight line), the Grendon Underwood and Princes Risborough Railway (GRS020), and associated railway structures (GRS011, GRS012, GRS013, GRS018 and GRS022); and
- a former drover route identified on the ordnance survey map of 1813 (GRS039).

Cultural Heritage Overview

8.4.9 The solid geology in the study area is dominated by undulating claylands comprising heavy blue-grey clays. Alluvial deposits are recorded around the tributaries of the River Ray east of Sheephouse Wood (within the land required for the Proposed Scheme) and south west of Woodlands Farm. Such deposits have the potential to contain deposits of palaeo-environmental and archaeological interest.

8.4.10 No prehistoric or Roman archaeological evidence has been identified within the study area. This may reflect the unsuitability of the heavy clays for exploitation during these periods but may also reflect the limited amount archaeological investigation that has been undertaken within the study and wider area. The small town at Fleet Marston was located 9km to the south east of the Proposed Scheme. This small town can be expected to have had an extensive hinterland of agricultural settlements in order to support it; these could be in the form of both farmsteads and villa estates. Associated remains are likely to extend along the Akeman Street Disused Railway (now Greatmoor Road), which is located at the southern end of the Greatmoor EfW facility access road (which will be used by the Proposed Scheme) 3km to the south of the study area.

8.4.11 The study area formed part of the Royal Forest of Bernwood throughout the medieval period (1066-1540) and included a mosaic of habitat and land use types including woodland. It should be noted that 'forest' in this sense does not necessarily mean woodland or trees. The word may have originally been derived as a description of a place outside the ordinary law, and subject to special laws concerned with preserving game, specifically deer. The legal forest was nearly always much larger than the physical woodland.

8.4.12 Elements of Bernwood Forest survive as remnant ancient woodland within the study area (GRS027, GRS028, GRS029, GRS030, GRS031, GRS032, GRS033, GRS034, GRS035, GRS036), and there is potential for medieval earthwork banks and linear features to survive in these woods.

8.4.13 A former medieval grange of Thame Abbey was recorded outside of the study area at Shipton Lee. The earthworks remains of an medieval chapel/hermitage associated with this Grange (GRS014) have been identified within the study area close to Finemerehill House (GRS001).

8.4.14 Open field strip fields in the form of ridge and furrow cropmarks and earthworks were recorded across the study area, as part of the remote sensing survey identified in areas L31, L32, L33, L34, L35, L36, L37, L38, L39, L40, L41, L42 and L43 (summarised in Volume 4.07: Environmental Statement Technical Appendix: Cultural heritage remote sensing survey summary and shown on Map ES-14: Remote Sensing Survey results in Volume 3 of this ES).

8.4.15 The ridge and furrow remains within the study area are located many kilometres away from the nearest historic village cores, in areas adjacent to ancient woodland (associated with the Forest of Bernwood). This suggests that these features represent the remains of assorted (woodland clearance) fields, potentially associated with the Grange (and hermitage) and/or small demesne farms. These remains are likely to reflect land management in the late medieval/early post medieval period, following the disforesting of the Royal Forest.

8.4.16 The landscape within the study area was enclosed in a piecemeal fashion from the 16th century onwards. The landscape around Doddershall House (GRS002) (to the south of the study area) was enclosed from 1495 and other areas may have seen similar early enclosure, before parliamentary enclosure was carried out in the 18th and 19th centuries.

8.4.17 Many of the farmhouses and associated agricultural buildings in the study area were built between the 17th and 19th centuries. These include Lower Great more House GRS003), Finemerehill House (GRS001), Knowlhill Farm (adjacent (north east) of the study area) and a former farm complex (GRS015) located between Lower Greatmoor House and Finemerehill House. These farms were linked to the settlements at Quainton and Grendon Underwood by a drove way (GRS039) and Three Points Lane (GRS038).

8.4.18 Archaeological investigations to the west of Lower Greatmoor House (GRS026), in advance of the construction of Greatmoor EfW facility, identified 15th to 17th century settlement remains. These remains were associated with the former route of the drove way (GRS039).

8.4.19 The land required for the Proposed Scheme is located along and either site of the route of the London extension of the Great Central Railway (now used as a freight line for FCC), a railway line established in the late 19th-century (GRS019). Modern development within the study area is limited, comprising modern Calvert brick works clay pits (GRS025) (now used for landfill) to the south of Sheephouse Wood, and Greatmoor EfW facility which is located directly to the south west of the land required for the Proposed Scheme.

Consultation

8.4.20 Consultation has been undertaken with the local authority historic environment advisors, the Buckinghamshire Historic Environment Services. It has been agreed that a programme of non-intrusive and intrusive archaeological evaluation can be undertaken post determination of the TWAO.

Future baseline

8.4.21 Construction of the HS2 Phase One scheme is expected to remove all archaeological remains (including the historic railway structures) located within the land required, temporarily or permanently for the construction of the Proposed Scheme.

8.5 Effects arising during construction

Avoidance and mitigation measures

8.5.1 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction.

8.5.2 Protection measures will be put in place to avoid impacts to the significant assets.

Assessment of impacts and effects

Temporary effects

8.5.3 The construction works, comprising excavations and earthworks, landscape/ecology planting, and including temporary works such as construction compounds, storage areas and diversion of existing roads and services have the potential to affect heritage assets during the construction period. Impacts will occur to assets both within the land required, temporarily or permanently, for the construction of the Proposed Scheme and assets in the wider study area due to the visibility of plant, rail mounted gantry crane and equipment and other construction factors.

8.5.4 The following significant effects will occur as a result of impacts to the setting of heritage assets within the land required, temporarily or permanently, for construction of the Proposed Scheme.

8.5.5 The boundary of the land required for the Proposed Scheme lies approximately 140m to the west of Finemerehill House (GRS001). The historical coherence of this asset lies partly in its prominent location on Finemere Hill. The asset's location on the hill with views across 'Greatmoor' towards Aylesbury Vale and the views towards the asset from 'Greatmoor' and the wider area is a significant part of how the asset's character is appreciated. The construction of the Proposed Scheme, including the planting works, will temporarily alter the view degrading how the asset is appreciated. This will result in a medium adverse impact and a moderate adverse effect.

Permanent effects

8.5.6 The following significant effects will occur as a result of physical impacts on heritage assets within the land required, temporarily or permanently, for construction of the Proposed Scheme.

8.5.7 There will be a permanent change in the setting of Finemerehill House (GRS001), from the change in the views from the property to west and north west. The landscape of open farmland (but with industrial elements from the Greatmoor EfW facility and Calvert landfill), will be changed with the introduction of landscape features (planting), changing the landscape to more of a wooded character.

8.5.8 In addition, the house is a prominent feature in the surrounding landscape (from the west and north west). The introduction of planting will permanently alter the appreciation of the character of the asset (which will remain prominent) but will be viewed in a wooded landscape rather than in an agricultural one. The changes in setting of the asset will result in a medium adverse impact and a moderate adverse effect.

8.5.9 Buried archaeological remains associated with the post medieval drove way (GRS039) and the remnants of the medieval/post medieval ridge and furrow (L33, L34, L36, L38, L39 and L41), which are present within the land required for the construction of the Proposed Scheme, will be recorded and removed. This will cause a high impact on assets of low value causing a moderate adverse effect.

Cumulative effects

8.5.10 The combined cumulative effect of the HS2 Phase One scheme, the EWR2 upgrade and the Proposed Scheme, will have the following significant effects:

- the surviving historic elements of the Great Central Railway and associated railway structures including bridges, underpasses and points (GRS011, GRS012, GRS013, GRS018, GRS019 and GRS022) will be removed by the construction of the schemes. This will cause a major impact on assets of low value causing a moderate significant effect; and
- the setting appreciation of the character of Finemerehill House (GRS001) will be permanently altered by the construction of HS2 Phase One scheme, the EWR2 upgrade and the Proposed Scheme. The prominence and visibility of the assets will be diminished by the presence of new structures and by the changes in the surrounding landscape with the introduction of new woodland. This will cause a medium impact on the asset causing a moderate significant effect.

Other mitigation measures

8.5.11 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme or included in the draft CoCP will be considered during detailed design to reduce further the significant effects described above. These refinements will include the identification of locations where the physical impact on below ground assets can be reduced through design.

Summary of likely significant residual effects

8.5.12 The Proposed Scheme will result in the permanent adverse significant effect through the loss of any potential archaeological remains that may be present within the Proposed Scheme area. An appropriate programme of investigation and recording would be undertaken in relation to any archaeological remains. In addition, there will be a permanent (moderate) residual effect in the setting and appreciation of Finemerehill House, from the changes to the surrounding agricultural landscape and the introduction of new rail infrastructure into the key views from the asset.

8.6 Effects arising from operation

Avoidance and mitigation measures

8.6.1 Landscape/ecology planting has been incorporated into the design of the Proposed Scheme, which will progressively reduce impacts on the setting of the designated assets within the study area as it matures over time during the operational phase.

Assessment of impacts and effects

8.6.2 The assessment considers the Proposed Scheme once operational and all effects are considered to be permanent. There will be no physical impacts on buried

archaeological remains or other heritage assets arising from the operation of the Proposed Scheme. Impacts on the setting of heritage assets arising from the physical presence of the Proposed Scheme are described as permanent occurring within the construction stage and are not repeated in detail here, albeit that they will endure through operation.

8.6.3 No significant environmental effects will occur as a result of permanent changes to the setting of the heritage assets arising from the operation of the Proposed Schemes.

Cumulative effects

8.6.4 Although there will be no significant effects on the setting of the heritage assets arising from the operation of the HS2 Phase One scheme, the EWR2 upgrade and the Proposed Scheme, the combined cumulative effect on the setting of Finemerehill House will be significant. The operational noise of both railways, the Proposed Scheme and the combined visual impact of night time (lighting etc.) and day time operation (train and vehicle movements) will have a significant effect on how the asset is appreciated from the wider landscape. The changes in setting of the asset will result in a medium adverse impact and a moderate adverse effect.

Other mitigation measures

8.6.5 No additional mitigation measures are required.

Summary of likely significant residual effects

8.6.6 There will be no significant residual effects during operation.

9 Ecology

9.1 Introduction

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

9.1.2 Only significant effects have been reported within this section. For details on all non-significant effects, refer to Volume 4.08: Environmental Statement Technical Appendix: Ecology baseline data, survey results and non-significant effects.

9.2 Assessment methodology

Scope, assumptions and limitations

9.2.1 The assessment scope, key assumptions and limitations for the ecology assessment are as set out in the HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

9.2.2 Where aspects of the scope and methodologies set out in these documents are not applicable to this assessment then deviations from these are stated in this section.

9.2.3 The SMR identified potential construction and operational activities that could give rise to adverse ecological effects. The construction activities that are considered to potentially give rise to adverse ecological effects on the Proposed Scheme are:

- the permanent loss of habitat through vegetation clearance required for construction;
- permanent fragmentation of habitats;
- noise, visual and light disturbance to species that may be present;
- hydrological changes; and
- deposition of air and waterborne pollution to woodland and watercourses.

9.2.4 Habitat loss and fragmentation, and disturbance caused by construction activities could result in the degradation of a wider network of habitats that is important to maintain the conservation status of bat populations in the Bernwood Forest.

9.2.5 Potential effects resulting from operation of the Proposed Scheme include:

- disruption of birds and bats due to emissions of light and noise; and
- the potential for animal mortality, including bats due to collision with trains; and
- deposition of air and waterborne pollution to woodland and watercourses.

9.2.6 The impact assessment methodology for the Proposed Scheme follows the methodology established for the HS2 Phase One ES, but taking account of

modifications in the revised Chartered Institute of Ecology and Environmental Management (CIEEM) guidance set out in their Guidelines for Ecological Impact Assessment (2nd Edition, 2016). This is a deviation from the SMR which considered the methodology set out in the first edition of the IEEM Guidelines for Ecological Impact Assessment (IEEM, 2006).

Surveys/source of information

9.2.7 The ecological baseline for the assessment takes into account baseline information collected in support of the HS2 Phase One scheme, which included field survey data starting in 2012, aerial photography and relevant existing information gathered from national organisations and from regional and local sources. This includes records received from BCC; AVDC; BBOWT; North Bucks Bat Group and the Bernwood Forest Bechstein's Project.

9.2.8 A full list of data sources which informed the HS2 Phase One ES is provided in the HS2 Phase One ES, Volume 5, Appendices EC-001-002 (designated sites, habitats and flora), EC-002-002 (amphibians, reptiles and birds), EC-003-002 (mammals, including bats), EC-004-002 (invertebrates and fish) and EC-006-002 (bat tracking and radio tracking study for Bernwood Forest: Waddesdon to Chetwode) of the HS2 Phase One ES.

9.2.9 Surveys were undertaken in 2014 for the SES and AP2 ES and baseline data is provided in HS2 Phase One ES, Volume 5; Appendices EC-001-002 (amphibians, bats, white-clawed crayfish) and EC-004-002 (1) (CFA 12 and 13: Bat Trapping/Radio-Tracking Study 2014- Bernwood Forest).

9.2.10 Baseline data for amphibians collected during 2015 is provided in SES3 and AP4 ES, Volume 5, Ecology Technical Appendix, Supplementary amphibian data (EC-001-002).

9.2.11 Baseline data for bats collected during 2015 and 2016 is provided in Volume 4.08: Environmental Statement Technical Appendix: Ecology baseline data, survey results and non-significant effects.

Study area

9.2.12 The geographic scope of the assessment is defined by the area where potential ecological impacts are likely to occur. This includes not just the physical extent of land-take associated with the Proposed Scheme, but also includes associated activity, such as, the construction of haul routes and land drainage areas, and creation of mitigation areas. It also includes areas that may be affected by noise, light and dust.

9.2.13 Natural England have developed Impact Risk Zones (IRZ)[29] to allow a preliminary assessment of potential effects on statutory sites of nature conservation importance to be made, taking account of the location, scale and nature of the proposal. Broadly, the range of potentially significant developments decreases with distance from a particular site. IRZ have been used to scope the potential effects of the Proposed Scheme on SSSIs. No Natura 2000 sites are likely to be affected.

[29] http://magic.defra.gov.uk/Metadata_for_magic/SSSI%20IRZ%20User%20Guidance%20v2.5%20MAGIC%2010Mar2016.pdf accessed 22/04/16

9.2.14 The extent of the assessment will also reflect the distribution of populations and assemblages of species potentially affected by the construction and operation of the Proposed Scheme. In the case of Bechstein's bat and other woodland bat species, black hairstreak butterflies, and birds (including barn owls) the area of assessment includes relevant areas of woodland, grassland and arable habitats within the former Bernwood Forest in the vicinity of the Proposed Scheme.

9.3 Legislation and planning policy framework

9.3.1 The legislative framework is described in the HS2 Phase One ES, Volume 5, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

9.3.2 The key planning policies relevant to the consideration of ecological impacts include the national planning policy documents listed in the SMR, such as the NPPF (2012), and the Vale of Aylesbury Local Plan Draft Plan for Summer 2016 Consultation Draft Plan for Summer 2016 of which Section 9 Natural Environment contains the following proposed policies:

- NE1 Protected sites, addresses development proposals would lead to an individual or cumulative substantial adverse impact on SSSIs, ancient woodland or ancient trees. The council will balance the overall benefits of the proposal against the impact.
- NE2 Biodiversity, protection and enhancement of biodiversity and the natural environment, will be achieved by measures including seeking a net gain in biodiversity; ensuring that significant harm is mitigated or, as a last resort, compensated; protection of internationally important sites, nationally important sites including SSSI and Local Wildlife Sites; provision of adequate ecological information in accordance with nationally accepted standards; retention and where possible enhancement of existing features of nature conservation value and wildlife networks; work towards implementation of Biodiversity Opportunity Areas; and monitoring and management plans for biodiversity features.

9.4 Environmental baseline

9.4.1 This section describes the ecological baseline relevant to the assessment for the designated sites, habitats and species recorded in this area. It includes field survey data and relevant existing information gathered from national organisations and from regional and local sources.

Existing baseline

Designated sites

9.4.2 There are four SSSI relevant to the assessment in this area; each is of national importance. They are all designated for ancient woodland and assemblages of plants, woodland birds and invertebrates. They are:

- Sheephouse Wood SSSI (56.9ha) – designated for ancient woodland habitats and associated assemblages of birds, invertebrates and plants, including three species of woodpecker, woodcock and black hairstreak butterfly. It is

approximately 30m north of the operational sidings of the Proposed Scheme;

- Finemere Wood SSSI (47.9ha) – designated for ancient woodland and assemblages of plants, woodland birds and invertebrates. In particular the wood contains populations of butterflies, including the wood white and black hairstreak, which are both endangered[30] and have a highly localised distribution in southern England. There are a wide variety of woodland and scrub nesting birds. It is approximately 170m from the reception sidings and approximately 600 m from the operational sidings of the Proposed Scheme;
- Grendon and Doddershall Woods SSSI (67ha) – features cited as reasons for its designation include the presence of ancient woodland with network of wet woodland rides, and breeding bird and butterfly populations. Notable species include nightingale and purple emperor butterfly. It is approximately 650m west of the land required for the construction of the Proposed Scheme; and
- Ham Home-cum-Hamgreen Woods SSSI (23ha) – designated for mixed and yew woodland, parts of which are ancient semi-natural woodland. Notable species include black hairstreak butterfly and breeding nightingale. It is approximately 680m from land required for the construction of the Proposed Scheme but approximately 100m of the site's boundary is adjacent to the A41 Bicester Road, which will be used by construction traffic.

9.4.3 Greatsea and Romer Wood LWS (36.9ha) – is designated for the presence of large areas of woodland much of which is replanted although it retains older woodland at the margins. It is approximately 30m north of the land required for the Proposed Scheme and is of county importance.

9.4.4 An unnamed Biological Notification Sites (BNS) is relevant to the assessment. It comprises a track leading to the Aylesbury Link railway line (the name used for this site hereafter) (0.7ha) to the north of Oak Tree Farm and is designated for calcareous flora including plants that are uncommon in Buckinghamshire, including spiny restharrow. Although there are extensive areas of calcareous vegetation in the south of Buckinghamshire it is scarce in the north of the county, hence this site is of county importance[31]. The BNS will be partly within the land required for construction of the Proposed Scheme.

9.4.5 BBOWT's Finemere Wood nature reserve includes a large area of semi-improved grassland in addition to Finemere Wood SSSI. The western edge of the grassland is within the land required for the construction of the Proposed Scheme. This site is not subject to formal designation as an LWS and as such its importance is described only in terms of its habitat quality.

9.4.6 Two other areas of ancient woodland, which have not been included within the designated sites described above, are relevant to this assessment. An area of un-

[30] Fox, R., Warren, M.S., and Brereton, T.M. (2010). A new Red List of British Butterflies, Species Status 12; 1-32. Joint Nature Conservation Committee, Peterborough.

[31] In addition to LWSs, there is a category of sites that are in the process of being reviewed and assessed against the LWS criteria. These sites are known as Biological Notification Sites (BNSs) and until the programme of review has been completed, it is important they are treated in the same way as LWSs.

named ancient semi-natural broadleaved woodland of approximately 1.43ha in extent is present 30 m north of the land required for the construction of the Proposed Scheme. It was historically part of the large area of ancient woodland that is designated as Sheephouse Wood SSSI but is separated from it by the Aylesbury Link Railway[32]. Hewin's Wood is situated approximately 570 meters south-west of the Proposed Scheme. Ancient woodland represents an irreplaceable resource and both areas are part of a resource of county importance.

Habitats

Woodland

9.4.7 The majority of ancient woodland in the area is within the designated sites of Sheephouse Wood SSSI, Finemere Wood SSSI, Grendon and Doddershall Woods SSSI and Greatsea and Romer Wood LWS.

9.4.8 Sheephouse Wood is ancient semi-natural broadleaved woodland and most is an example of lowland mixed deciduous woodland a habitat of principal importance as identified in Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006)[33], and a local Biodiversity Action Plan (BAP) habitat. Soil type and drainage vary across the site with corresponding variety in dominant species. The main stand type is described in the SSSI citation as lowland hazel - pedunculate oak woodland, with smaller amounts of wet field maple woodland concentrated along the north and east margins. There is a diverse range of associated tree species including wild service tree, an ancient woodland indicator species. The shrub layer and ground flora are also diverse and contain a number of ancient woodland indicators. The larger part of this woodland, to the east of the Aylesbury Link railway line is of national importance in accordance with its designation as an SSSI. The smaller fragment to the west of the railway is discussed in paragraph 9.4.12.

9.4.9 Finemere Wood is largely ancient semi-natural woodland and parts are lowland mixed deciduous woodland - habitat of principal importance. The majority comprises pedunculate oak over hazel with scattered field maple, aspen and ash. Areas of ancient ash maple woodland are of note, as are stands of old hornbeam coppice. The shrub layer is very diverse, as is the ground flora which contains several ancient woodland indicators including wood anemone, woodruff, yellow archangel and wood barley. The habitat is of national importance.

9.4.10 Ham Home-cum-Hamgreen Woods is largely ancient semi-natural woodland and parts are the habitat of principal importance lowland mixed deciduous woodland. It is dominated by pedunculate oak with frequent maple, ash, willow and wild service tree. The shrub layer includes wych elm, hawthorn, privet and blackthorn. The habitat is of national importance.

9.4.11 The majority of Greatsea and Romer Wood is recent plantation of pedunculate oak and pine, with a limited ground flora, but nonetheless is important as a large area of ancient replanted woodland. The habitat is of county importance.

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[32] The cultural heritage section discusses Sheephouse Wood in its entirety and therefore information on the extent and boundaries of the ancient woodland, and on the effects of the Proposed Scheme are described differently in the two chapters.

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

9.4.12 An approximately 1.43ha strip of ancient semi-natural woodland adjacent to Calvert Landfill was once part of Sheephouse Wood, from which it has been split by the construction of the Aylesbury Link railway line. It resembles the NVC community for ash maple woodland W8 *Fraxinus excelsior – Acer campestre – Mercurialis perennis* woodland. The canopy is dominated by pedunculate oak, with the shrub layer dominated by bramble, field rose, hawthorn and hazel. It includes several ancient woodland indicator species including wood millet, midland hawthorn and hairy wood - rush. The area is the habitat of principal importance lowland deciduous woodland, and is a local BAP habitat. Due to its quality and proximity to other ancient woodlands, it is of county importance, despite its small size. Hewin's Wood is also classified as lowland deciduous woodland and is of county importance due to its proximity to other ancient woodlands.

Grassland

9.4.13 The track leading to the Aylesbury Link railway line includes narrow strips of calcareous grassland to each side. They are dominated by red fescue and common bent, and contain meadow oat grass in addition to other calcareous grassland indicator species including spiny restharrow as noted in its description as a designated site. The habitat is of county importance.

9.4.14 The grassland at BBOWT's Finemere Wood nature reserve is dominated by crested dog's tail and red fescue, with limited diversity and abundance of broad leaved species, including wild carrot, yellow rattle, agrimony and common fleabane. It broadly matches the crested dog's tail – black knapweed grassland community MG5 *Cynosurus cristatus - Centaurea nigra* grassland. This grassland has been managed to increase its diversity, but currently most of the broad leaved species are sparsely distributed and there is little variation in the plant communities present. The habitat is of district importance.

9.4.15 Small areas of disturbed but species-rich marshy grassland along parts of the Muxwell Brook include abundant glaucous sedge and carnation sedge (scarce in Buckinghamshire), as well as occasional southern marsh orchid (rare in Buckinghamshire) and ragged robin. They are similar to the crested dog's tail – marsh marigold NVC community MG8 *Cynosurus cristatus - Caltha palustris* grassland. Although lowland meadow, these areas are small, and encroachment by coarse grasses has reduced their quality. These habitats are of district importance.

9.4.16 A complex mosaic of grassland communities is present on the banks of a large drainage ditch, the Mega Ditch[34], at the southern end of the Calvert Estate. A variety of different grassland types were present including those resembling MG5a *Cynosurus cristatus - Centaurea nigra* grassland, *Lathyrus pratensis* sub- community and MG1a *Arrhenatherum elatius* grassland, *Festuca rubra* sub- community. The bottom of the ditch had a moderately species-rich neutral grassland with crested dog's-tail and a variety of broad leaved herbs, e.g. bird's-foot trefoil, selfheal and meadow buttercup. The vegetation is of insufficient diversity overall to qualify as a habitat of principal importance - lowland meadow and is therefore considered of local/parish importance.

[34] Deepened and widened diversion of the Muxwell Brook close to Sheephouse Wood and adjacent to parts of the Bridleway GUN/25, containing scattered scrub and wetland vegetation.

9.4.17 Semi-improved grassland near Oak Tree Farm, parts of which contain occasional cowslip and black knapweed, is similar to MG5 *Cynosurus cristatus - Centaurea nigra* grassland. It is small and isolated and the few broadleaved species were present in small quantities. The habitat is of local/parish importance.

9.4.18 Other grassland habitat in this area (including arable field margins, which are a habitat of principal importance) within or adjacent to land required for the construction of the Proposed Scheme is dominated by improved and species-poor neutral grassland. Therefore this habitat is considered of local/parish importance.

Scrub

9.4.19 Areas of scrub, mainly along the Aylesbury Link railway line and River Ray corridor are dominated by hawthorn with occasional rose and willow species, as well as areas of false-oat grass. The habitat along the Aylesbury Link railway line is largely continuous along the southern side of the railway line, but there are gaps along the northern side between Benfield's overbridge and Sheephouse Wood. This habitat is of local/parish importance.

Watercourses

9.4.20 The Muxwell Brook is approximately 30m to the north of the Proposed Scheme and the River Ray is 450m to the south. Both have uniform channel profiles, dense shading and limited growth of aquatic and marginal plants and are therefore considered a habitat of local/parish importance.

Hedgerows

9.4.21 The majority of hedges in this area are composed of native species and qualify as a habitat of principal importance. The hedgerow within the land required contains five woody species and ditch along part of its length. Most of the hedgerows are intact and provide connectivity across the arable landscape. Typical species include hawthorn, blackthorn, rose species, elder and pedunculate oak. Midland hawthorn is also locally present in this area around Finemere Wood. The hedgerows within and adjacent to the Proposed Scheme are part of a wider well-managed and moderately species-rich network of hedgerows that is a habitat of district importance.

Ponds

9.4.22 The single pond within the land required for the Proposed Scheme and several that are close to it contain great crested newts and therefore qualify as a habitats of principal importance. The pond forms part of a wider resource of ponds in the area which is considered to be a habitat of up to district importance.

Arable and cultivated land

9.4.23 Arable farmland is a dominant habitat type within and adjacent to the Proposed Scheme. Arable field margins (a habitat of principal importance) are present within the land required. A small traditional orchard (a habitat of principal importance) is present immediately opposite the Proposed Scheme, on the western side of the existing Aylesbury Link railway line. These habitats are of local/parish importance.

Other habitat

9.4.24 Other habitats present within the land required for the Proposed Scheme include scattered trees, a number of drains associated with arable land and existing railway infrastructure. Bare ground and standing water are present in the Calvert landfill site to the north of this area.

Species

Bats

9.4.25 Bernwood Forest is an area of ancient woodlands and intervening farmed landscape supporting an important assemblage of bat species.

9.4.26 The population of Bechstein's bat in Bernwood Forest is one of the largest known populations in the UK. It is one of the rarest bats in the UK on the north western edge of its known distribution in Europe. This population is therefore of national importance.

9.4.27 Another rare woodland bat species, the barbastelle, has also been recorded in the vicinity of the Proposed Scheme, but no roosts have been recorded in the surrounding woodlands and commuting activity has been recorded for a single bat only. The population of barbastelle bat is considered to be of regional importance.

9.4.28 An assemblage of bats associated with woodland habitats (Brandt's, brown long-eared, Daubenton's, Natterer's and whiskered bats, in addition to Bechstein's) is also present and this assemblage is of regional importance.

9.4.29 All other recorded bat populations including common pipistrelle, Nathusius' pipistrelle and soprano pipistrelle bats for which there are nearby maternity roosts; and small populations of Leisler's, noctule and serotine bats. Are considered of up to county importance.

9.4.30 Surveys carried out by HS2 Ltd in 2012-2015 identified Bechstein's, Brandt's, common and soprano pipistrelle, Daubenton's and Natterer's bats flying along the existing Aylesbury Link railway line or the parallel Mega Ditch in the vicinity of the Proposed Scheme. The key points where bats cross this railway in this area are as follows:

- Grendon Junction crossing point associated with a flightline along the Muxwell Brook and between Hewin's Wood, Grendon and Doddershall woods and Finemere Wood. This corridor includes the former Akeman Street Disused Railway (now Greatmoor Road forming the access road to the Greatmoor EfW facility) and Bridleway GUN/35/1. It is used by Bechstein's, Brandt's, brown long-eared, Daubenton's and Natterer's bats;
- Benfield's overbridge; crossing point associated with a flightline between Hewin's Wood, Grendon and Doddershall woods, and Sheephouse Wood and Finemere Wood and used by Bechstein's bats; and
- Costello underbridge associated with a flightline between Grendon Wood and Doddershall woods and Sheephouse Wood and used by Bechstein's, Brandt's, brown long-eared and Natterer's bats.

9.4.31 No bat roosts have been found within the area of the Proposed Scheme despite detailed bat studies in the area. Two trees with high potential as bat roosts will be removed as part of the Proposed Scheme. The removal of two further trees within the land required is understood to be undertaken in 2017 in order to establish a vegetation management zone in order to reduce the risk of bats flying close to high speed trains.

9.4.32 The closest Bechstein's roosts to the Proposed Scheme are in Sheephouse Wood of which one is 50m from the northern boundary of the Proposed Scheme. Brandt's, brown long-eared and Natterer's bats are also present in the south-western part of Sheephouse Wood. The closest known Bechstein's maternity roost is north of Finemere Wood and located approximately 400 m from the reception sidings. This roost is 50 m from the woodland planting forming part of the Proposed Scheme and is adjacent to that provided in the HS2 Phase One scheme.

Invertebrates

9.4.33 A population of black hairstreak butterfly is in the vicinity of the Proposed Scheme, with the closest colonies located at Grendon Junction, the former Akeman Street disused railway, Three Points Lane, Sheephouse Wood and Finemere Wood. Black hairstreak are endangered in the UK[35] and the populations in this area are important in maintaining the distribution of black hairstreak in the southern part of this range. This assemblage is of regional importance

9.4.34 The invertebrate assemblage associated with habitat at Grendon Junction and retained habitat along Greatmoor Road (the former Akeman Street Disused Railway) contained 11 Nationally Scarce/Nationally Notable species, including records for dingy skipper and grizzled skipper which are both species of principal importance. This assemblage is of regional importance.

9.4.35 Colonies of brown hairstreak are present in the vicinity of Calvert Jubilee Nature Reserve LWS, in Finemere Wood and in Grendon and Doddershall woods. It is a species of principal importance with a restricted distribution in southern England and this population is therefore of regional importance.

9.4.36 The invertebrate assemblage associated with semi-improved grassland in the BBOWT Finemere Wood nature reserve supports the weevil *Hypera meles*, which is a Nationally Notable species, and is therefore of local/parish importance

9.4.37 Two 'Notable' beetle species and a moderate diversity of macroinvertebrate taxa including freshwater shrimp, stonefly nymph, riffle beetle, and a variety of caddis larvae are present in the Mega Ditch and are of district importance. The assemblage of aquatic invertebrates in the Muxwell Brook is of local/parish importance.

Birds

9.4.38 The assemblages of woodland birds including three species of woodpecker, woodcock and nightingale that are present in Sheephouse Wood, Finemere Wood and Grendon and Doddershall Woods are of national value, as they form a reason for the

[35] Fox, R., Warren, M.S., and Brereton, T.M. (2010). A new Red List of British Butterflies, Species Status 12; 1-32. Joint Nature Conservation Committee, Peterborough

designation of the these woods as SSSI. However, the habitats in the land required for the Proposed Scheme are of limited extent and of little value for these species.

9.4.39 Cuckoo have been recorded in scrub and open habitats in the vicinity of the Proposed Scheme, and there are desk study records for tree sparrow. However, due to the limited extent of habitats, the area of the Proposed Scheme is no more than of district importance for these species.

9.4.40 The barn owl population north-west of Quainton comprises two breeding pairs which represents more than 1% of the county population and is therefore of county importance. No confirmed barn owl nest sites were recorded within land required for construction of the Proposed Scheme, but several mature trees were assessed as having potential to support breeding barn owl.

Amphibians

9.4.41 The great crested newt metapopulation associated with breeding ponds in BBOWT's Finemere Wood nature reserve and the adjoining part of the Calvert Estate (including land required for the Proposed Scheme), as well as ponds near Woodlands Farm and to the east of Calvert landfill site is of medium size and therefore of county importance.

Reptiles

9.4.42 The assemblage of common reptiles near the existing Aylesbury Link railway line, Woodlands Farm and Oak Tree Farm comprised three species; common lizard, slow worm and grass snake, the latter species present in high population densities. These populations are probably linked by railway and river corridors to those on land at Calvert landfill, at Calvert Jubilee LWS, and on nearby parts of the Aylesbury Link railway line near Steeple Claydon. The assemblage is of county importance due to the presence of three species.

Otter

9.4.43 Field surveys recorded a single otter spraint on the River Ray, confirming that otter(s) are present within this catchment. One area with potential to be used as a holt was identified, but with no evidence of use. No records of otter were provided in the desk study. The otter population associated with the River Ray is of district importance.

Badger

9.4.44 Surveys in 2013 identified an annexe badger sett close to the land required for the Proposed Scheme and further setts in areas nearby. Badgers are common and widespread in Buckinghamshire and the UK, and the species is not threatened or vulnerable. This population is therefore of local/parish importance.

Future baseline

9.4.45 The construction of the proposed HS2 Phase One scheme is expected to commence in 2017. The EWR2 upgrade is also located adjacent to the Proposed Scheme. EWR2 proposes to upgrade the existing Aylesbury Link railway line to increase the frequency of train services in 2022. The EWR2 upgrade in the vicinity of the Proposed Scheme will be entirely within the railway corridor thus minimising loss of adjacent habitat.

However, some additional small scale clearance of line-side vegetation within the railway corridor, prior to 2019, is likely.

9.4.46 Habitat loss from the unnamed BNS comprising a track leading to the Aylesbury Link railway line is caused solely by the construction of Bridleway QUA/36 accommodation green overbridge provided by the proposed HS2 Phase One scheme. Therefore the Proposed Scheme has no effect on this habitat.

9.4.47 The areas of habitat loss caused by the Proposed Scheme and the area of each habitat already removed by the HS2 Phase One scheme are provided in Table 6. Both sets of figures include the extent of land required for ecological and landscape mitigation.

Table 6: Summary of habitat areas (hectares) lost as a result of the Proposed Scheme and areas already lost by HS2 Phase One scheme

Habitat type	Area (ha) within the land required for the Proposed Scheme removed by the HS2 Phase One scheme	Additional habitat area (ha) within the land required for the Proposed Scheme removed by the Proposed Scheme	Total area removed (ha)
Broadleaved woodland - semi-natural	1.73	0.06	1.80
Broadleaved woodland - plantation	0.28	0.00	0.28
Scrub - dense/continuous	3.55	1.38	4.93
Scrub - scattered	0.76	0.84	1.60
Neutral grassland - semi-improved	1.15	0.46	1.60
Improved grassland	0.29	0.33	0.62
Marsh/marshy grassland	0.08	0.00	0.08
Poor semi-improved grassland	4.67	2.42	7.09
Standing water	0.12	0.03	0.16
Cultivated/disturbed land - arable	4.18	11.34	15.52
Cultivated/disturbed land - ephemeral/short perennial	0.64	0.10	0.75
Bare ground	1.08	0.00	1.08
Other habitat	0.22	0.00	0.22

9.4.48 There will be no additional loss of habitat supporting a regionally important assemblage of invertebrates at Grendon Junction and Greatmoor Road to that required for the construction of the HS2 Phase One scheme. Therefore the Proposed Scheme has no effect on this assemblage.

9.4.49 The effects of the proposed HS2 Phase One scheme and the mitigation provided to address them; comprising the creation of replacement habitat and provision of underpasses, green bridges and associated linear planting to link roosts and foraging areas are described in the hybrid Bill ES (ES 3.2.1.12), SES and AP2 ES (ES 3.2.1.12) and SES3 and AP4 ES (ES 3.2.1.12).

9.4.50 The Greatmoor EfW facility, and access along Greatmoor Road from the A41 is now operational. The site is situated immediately south-west of the Proposed Scheme on the opposite side of the existing Aylesbury Link railway line. This development includes habitat creation that will be complete 2019 (and up to 2042 for Pit 6), during the final year of construction of the Proposed Scheme.

9.4.51 Ongoing management of grassland at Finemere Wood BBOWT Nature Reserve is likely to change the habitats and associated assemblages of species over time. Improved management of these sites will increase their diversity of grassland plants and invertebrates, but the sites are unlikely to exceed their currently stated ecological value.

9.4.52 Otter populations are increasing due to water quality improvements in river basins and other factors[36]. Their range is expected to increase throughout this area and, by the time of operation, it is possible that otter could be more numerous.

9.5 Effects arising during construction

Avoidance and mitigation measures

9.5.1 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction. Implementation of these measures, which includes translocation or exclusion of protected species where appropriate, has been assumed.

9.5.2 The Greatmoor Railway Sidings Rail Systems satellite compound is situated within the Proposed Scheme but civil engineering works will be managed from the Station Road overbridge satellite compound is situated approximately 3.5km south of the reception sidings. The use of Station Road overbridge satellite compound and the distance from Sheephouse and Finemere Woods will reduce the amount of disturbance (noise and light) during construction. Both Sheephouse Wood and Finemere Wood support roosting Bechstein's bat and other woodland bats, and an assemblage of breeding woodland birds.

9.5.3 The Bridleway GUN/28 accommodation green overbridge and Bridleway QUA/36 accommodation green overbridge are provided by the proposed HS2 Phase One scheme to maintain connectivity for bats that cross the railway at Benfield's overbridge and Grendon Junction. The span of both green bridges will increase in order to accommodate the construction and operation of the Proposed Scheme and Bridleway GUN/28 accommodation green overbridge will need to be widened to include vehicular access to the sidings. Construction of the GUN/28 and Bridleway and

[36] Tracking Mammals Partnership (2009) UK Mammals Update 2009. JNCC, Peterborough

QUA/36 accommodation green overbridges will take place prior to the construction of other elements of the Proposed Scheme. Once constructed, this will maintain the mitigation provided by the proposed HS2 Phase One scheme that will allow bats that currently cross the railway at these locations to continue to do so. However, there will still be a temporary severance of these flightlines during construction of the green bridges.

9.5.4 The crossing point for bats provided by the existing Costello underbridge will be maintained by the Footpath CAG/2 underbridge, which is of sufficient size to be used by the species present in the Bernwood Forest area.

9.5.5 The configuration of the Proposed Scheme avoids any loss of ancient woodland.

Assessment of impacts and effects

9.5.6 The following sections do not discuss non-significant effects. For reporting of non-significant effects, see Volume 4.08: Environmental Statement Technical Appendix: Ecology baseline data, survey results and non-significant effects.

Designated sites

9.5.7 The Proposed Scheme does not require any habitat loss from statutorily designated sites or LWS, but is in close proximity to Sheephouse Wood SSSI to the north and Finemere Wood SSSI to the south. The A41 Bicester Road, which will be used by construction traffic for the Proposed Scheme, is adjacent to the southern boundary of Ham Home-cum-Hamgreen Woods SSSI and therefore also relevant to the assessment.

9.5.8 The assessment of noise and air quality effects concluded that there would be no significant effect on Sheephouse Wood SSSI, Finemere Wood SSSI, Grendon and Doddershall Woods SSSI and Ham Home-cum-Hamgreen Woods SSSI.

Habitats

9.5.9 A single pond located to the south-east of the Bridleway GUN/28 accommodation green overbridge will be removed during construction of the Proposed Scheme. In the absence of mitigation, the permanent loss of this pond will result in a significant adverse effect on the conservation status of this habitat at up to district level.

9.5.10 It is unlikely that construction of the Proposed Scheme will result in any other significant adverse effects on habitat receptors of relevance.

Species

Bats

9.5.11 Populations of bats, including Bechstein's bats and a range of other woodland bat species, could be affected by the construction of the Proposed Scheme. The conservation status of these species, amongst other things, is dependent on the presence of suitable roosting and foraging habitat, habitat continuity and low levels of disturbance from noise, light and vibration.

9.5.12 Compared to that caused by the proposed HS2 Phase One scheme, the Proposed Scheme will increase the width of fragmentation of flightlines at Grendon Junction and Benfield's Overbridge by approximately 20m at both locations. No other

flightlines will be affected. No long-term adverse effects will occur due to the increase in the span of the Bridleway GUN/28 accommodation green overbridge and Bridleway QUA/36 accommodation green overbridge to cross both schemes. However, the Proposed Scheme will result in the temporary fragmentation of these flightlines from June 2017 to June 2018 and therefore affect part of the bat activity season in both years.

9.5.13 Generally construction activities will be carried out during standard working hours but some night time working will be required for work on the retaining wall of the existing Aylesbury Link railway line, for realignment of the access road to the Greatmoor EfW facility. These activities are likely to be sporadic and of short duration and will not significantly affect bat foraging and commuting activity.

9.5.14 Roosts of Bechstein's, Brandt's, brown long-eared and Natterer's bats are present in the south-western part of Sheephouse Wood. With the exception of Brandt's bat, roosts of these species are also present in the north-western part of Finemere Wood. The roosts in these locations are respectively potentially vulnerable to disturbance during construction of the operational sidings and the Bridleway QUA/36 accommodation green overbridge. Roosts of Bechstein's and other woodland bats have been recorded on the southern boundary of Sheephouse Wood approximately 30m from the Proposed Scheme. However, the magnitude of noise disturbance will be limited because the sidings are aligned away from the site, meaning that most construction activity will be at a greater distance. The operational sidings will require the compaction of materials, but any effect of vibration will be limited because it will not transmit readily through the ground. Night-time lighting during the construction of the operational sidings is likely to be limited, being required for the retaining wall of the existing Aylesbury Link railway line only, and light spillage would be controlled by the implementation of measures in the draft CoCP. Any impacts on roosts in Finemere Wood would be limited by distance, as they are at least 125 m from the land required, and because extended periods of night-time lighting are not required.

9.5.15 There will be no significant effects on the conservation status of Bechstein's bat or other woodland bats during the construction of the Proposed Scheme.

Amphibians

9.5.16 Construction of the operational sidings, reception sidings, the Bridleway GUN/28 accommodation green overbridge and the Bridleway QUA/36/2 accommodation green overbridge will result in the loss of aquatic and terrestrial habitat for the great crested newt population associated with breeding ponds in BBOWT's Finemere Wood nature reserve and the adjoining part of the Calvert Estate. The conservation status of great crested newts, amongst other things, is dependent on the presence of ponds close to suitable terrestrial habitat including grassland, woodland and scrub as well as the maintenance of habitat links between ponds.

9.5.17 Construction will result in the loss of a single pond containing a small population of great crested newts to the south-east of the Bridleway GUN/28 accommodation green overbridge. It will also remove terrestrial habitat comprising 0.15ha of scrub and 0.65ha of semi-improved grassland adjacent to the Aylesbury Link railway line. In the absence of mitigation, this will result in an adverse effect on the conservation status of

great crested newt, which, without mitigation, would be significant at the county level.

9.5.18 It is unlikely that construction of the Proposed Scheme will result in any other significant adverse effects on species receptors of relevance.

Cumulative effects

9.5.19 The construction of the Grendon Underwood Embankment, which forms the alignment of the HS2 Phase One scheme adjacent to the Proposed Scheme will commence in 2021. The HS2 Phase One scheme will result in a range of effects on ecological receptors described above, including:

- loss of habitat of ecological importance such as woodland (including ancient woodland), ponds, hedgerows, scrub and grassland;
- removal and disturbance of habitat used by populations of amphibians, bats, birds, invertebrates and reptiles; and
- fragmentation of habitat providing roosts and foraging areas for bats.

9.5.20 At BBOWT's Finemere Wood Nature Reserve, the removal of approximately 0.5ha of semi-improved neutral grassland will be additional to approximately 3.6ha removed by the HS2 Phase One scheme, but the combined loss will not result in a significant effect.

9.5.21 None of the additional areas of habitat loss caused by the construction of the Proposed Scheme (as summarised in Table 6) will have a significant cumulative effect with loss of habitat associated with the construction of the HS2 Phase One scheme.

9.5.22 The cumulative effects of disturbance and lighting on bats caused by the construction of the Proposed Scheme, proposed HS2 Phase One scheme and the EWR2 upgrade will be addressed through the implementation of a European Protected Species Mitigation Licence. This will ensure that the cumulative impacts from all three schemes are appropriately mitigated and the favourable conservation of the bat assemblage in the Bernwood area is maintained during the construction phase of all three projects. This will reduce the cumulative effects of disturbance and lighting on bats during construction to a level that is not significant.

9.5.23 The effects of habitat fragmentation on bats caused by the HS2 Phase One scheme are mitigated by the provision of the Bridleway GUN/28 and Bridleway QUA/36 accommodation green overbridges and Footpath CAG/2 underbridge. The span of both green bridges will increase and Bridleway GUN/28 accommodation green overbridge will need to be widened to accommodate the construction and operation of the Proposed Scheme. No cumulative effects from habitat fragmentation will occur.

9.5.24 The terrestrial and aquatic habitat loss associated with the Proposed Scheme, the proposed HS2 Phase One scheme and the EWR2 upgrade will result in an adverse effect on the conservation status of the great crested newt population associated with breeding ponds in BBOWT's Finemere Wood nature reserve and the adjoining part of the Calvert Estate which will be significant at the county level.

9.5.25 The Proposed Scheme involves the loss of 0.65ha of grassland and 0.15ha of scrub adjacent to the Aylesbury Link railway. This will not change the adverse effect of the proposed HS2 Phase One scheme and the EWR2 upgrade on the conservation status of the assemblage of common reptiles near the existing Aylesbury Link railway line, Woodlands Farm and Oak Tree Farm which will be significant at the county level.

9.5.26 Disturbance from the construction of the Proposed Scheme, alongside other work to construct the HS2 Phase One scheme and the EWR2 upgrade, would have a cumulative effect on the nearby pair of breeding barn owls and would result in a significant adverse effect at the county level.

Other mitigation measures

9.5.27 The Proposed Scheme will change the alignment of the Bridleway GUN/28 accommodation green overbridge in relation to planted habitat corridors provided in the HS2 Phase One scheme in order to reinstate habitat connectivity for bats. Therefore the habitat links from Grendon and Doddershall Woods and Hewin's Wood to the south-west of the proposed HS2 Phase One scheme and Finemere Wood to the east will be improved through additional planting immediately south-west of the Bridleway GUN/28 accommodation green overbridge. This will provide stronger connectivity above the access road to the Greatmoor EfW facility for Bechstein's bat and other woodland bat species to continue to utilise this key flightline between roost sites and foraging sites.

9.5.28 Where appropriate, temporary mitigation measures will be used, including mobile hedgerows and instant hedgerows which can be moved during the daytime to allow construction to take place, and be deployed at night to retain the linear flight line for bats during the construction phase. Key hedgerows will be translocated and augmented with live willow barriers.

9.5.29 The woodland planting described above will include additional ponds and areas of rough grassland along its margins that will compensate for the loss of the pond and provide additional habitat for amphibians and reptiles.

Summary of likely significant residual effects

9.5.30 The construction of the Proposed Scheme in combination with the construction of the HS2 Phase One scheme and the EWR2 upgrade will lead to disturbance of the nearby pair of breeding barn owls. This will result in a significant adverse residual effect on a cumulative basis on the conservation status of this species that is significant at the county level.

9.5.31 The mitigation measures described reduce the effects on all other receptors to a level that is not significant.

9.6 Effects arising from operation

Avoidance and mitigation measures

9.6.1 The span and width of the Bridleway GUN/28 accommodation green overbridge has been increased to provide a crossing point for HGVs over the Proposed Scheme, as well as the HS2 Phase One scheme. Both Bridleway GUN/28 accommodation green

overbridge and Bridleway QUA/36 accommodation green overbridge will provide a safe crossing point for bats once both schemes are operational.

9.6.2 Operational activities will be restricted in accordance with the operational timing restrictions to minimise effects on bats. Further details on lighting hours are contained within the report on "Operational Timing Restrictions to Minimise Effects on Bats", June 2016 (refer to Volume 4.01: Environmental Statement Technical Appendix: Additional information). HGV movement across the Bridleway GUN/28 accommodation green overbridge between the operational sidings and the Greatmoor EfW facility will not take place during these restricted hours and avoid any material overlap with sunrise or sunset during March to October, when bats are most active. Site activities including off-loading or loading of spoil or container trains will not take place when bats are active. Planning conditions on the consent for the Proposed Scheme will implement these mitigation measures.

9.6.3 The following measures will also avoid or reduce impacts to features of ecological value arising from the operation of the Proposed Scheme:

- environmental mitigation barriers (noise and light) on the GUN/28 accommodation green overbridge will shelter any bats active outside of the period from March to October from noise and light spillage associated with HGVs, when lorry movements will overlap with post-dusk and pre-dawn periods by approximately one hour;
- environmental mitigation barriers (noise and light) at the northern end of the operational sidings will shelter invertebrates, bat roosts and a flightline for bats along the southern edge of Sheephouse Wood from noise and light spillage associated with night time train movements;
- environmental mitigation barriers (noise and light) at the western side of Greatmoor EfW access road immediately opposite the Bridleway GUN/28 accommodation green overbridge will prevent light spillage from HGV movements that occur when bats are active onto the flightline from the bridge to Hewin's Wood and Grendon and Doddershall Woods SSSI, and
- the lighting strategy for the operational sidings avoid illumination of the Mega Ditch, Sheephouse Wood and the Bridleway GUN/28 accommodation green overbridge. Low level bollard lighting is to be provided alongside each of the reception sidings.

Assessment of impacts and effects

9.6.4 The following sections do not discuss non-significant effects. See Volume 4.08: Environmental Statement Technical Appendix: Ecology baseline data, survey results and non-significant effects.

Designated sites

9.6.5 Noise associated with the operation of the Proposed Scheme has the potential to disturb the assemblage of breeding birds at Sheephouse Wood SSSI. However, birds habituate to loud noises they hear regularly and frequently, which will limit the magnitude of any effect. Operational activity within the sidings will be a minimum of 75 m from the SSSI. Because the sidings are aligned away from the SSSI, most

operational activity will be at a greater distance. Therefore, any ongoing increase in noise is considered unlikely to result in a decrease in the density of breeding birds in the SSSI.

9.6.6 The operation of the Proposed Scheme would result in changes from increased nutrient nitrogen deposition that could result in effects on the special interest features that form the reason for designation of Sheephouse Wood SSSI. Nutrient nitrogen deposition can affect woodlands through eutrophication and can reduce resistance to drought, pests and diseases; as well as reducing diversity of ground flora and epiphytes and causing changes in soil biota. Deposition of nitrogen in woodland is strongly associated with edge habitat and are most prevalent in the first 50-100m (as recorded in transects from roads) but may be discernible at greater distances.

9.6.7 As reported in Volume 4.03: Environmental Statement Technical Appendix: Air quality impact assessment, the impacts change principally due to the movement of sidings activity from the current location, to the new location. The potential for significant effects is triggered by exceedance of a 1% increase in the critical load for nutrient nitrogen deposition. The threshold is an indicator that can be used to screen out significant effects, but does not confirm that such effects will occur if the threshold is exceeded.

9.6.8 Changes in nutrient nitrogen deposition compared to baseline levels could occur primarily due to emissions arising from the haulage of waste from the sidings to Calvert landfill site.

9.6.9 Critical loads vary according to habitat and thresholds and are lower for those characterised by slow growing plant species and epiphyte communities. Sheephouse Wood SSSI, which is classified as broad-leaved, mixed and yew woodland, includes species that can be adversely affected by nitrogen deposition, having a critical load of between 15-20 Kg N/ha/year.

9.6.10 In the absence of other mitigation measures the predicted total nitrogen deposition is 236% of the critical load. Therefore, the predicted environmental contribution[37] will exceed 70% of the relevant critical load in all parts of the site that will receive deposition in excess of 1% of the critical load, and is therefore likely to have a significant effect on the SSSI, which is significant at a national level.

Habitats

9.6.11 The effects on ancient woodland in the vicinity of the Proposed Scheme are as described for Sheephouse Wood SSSI above. The significance of effects is also the same.

9.6.12 It is unlikely that operation of the Proposed Scheme will result in any other significant adverse effects on habitat receptors of relevance.

[37] Environment Agency (2007), Appendix ASC 1 Environment Agency Stage 1 and 2 Assessment of New PIR Permissions under the Habitats Regulations

Species

9.6.13 Bechstein's bats and a range of other woodland bat species could be affected by habitat fragmentation and disturbance, and increased risk of mortality during the operational phase.

9.6.14 In order to accommodate the operation of the Proposed Scheme the width of Bridleway GUN/28 accommodation green overbridge will increase to include two lanes for the movement of HGVs from the Proposed Scheme and Greatmoor EfW facility. The HGV lanes will occupy the northern part of the green bridge, with a central green corridor and accommodation access/PRoW to the south. The movement of HGVs during operation of the Proposed Scheme across the Bridleway GUN/28 accommodation green overbridge could disrupt flight behaviour of bats due to the glare of headlights and cause them to avoid the bridge with the risk that they fly into the path of high speed trains. To avoid the risk of killing and injury of bats, no HGV movements across the bridge will be permitted at night time from March to October.

9.6.15 Noise and light disturbance caused by night time working in the operational sidings has the potential to cause disruption of the flightline recorded along the southern edge of Sheephouse Wood and including the existing Costello underbridge, which is replaced by Footpath CAG/2 underbridge in the proposed HS2 Phase One scheme. Without mitigation, this could result in fragmentation of roosts and foraging areas and increased risk of mortality from collision with trains, and may also disrupt foraging and roosting activity in the southern part of Sheephouse Wood. As detailed in the avoidance and mitigation measures section, measures restricting night time activities within the operational sidings along with provision of environmental mitigation barriers (noise and light) will reduce these effects.

9.6.16 It is unlikely that operation of the Proposed Scheme will result in any other significant adverse effects on species receptors of relevance.

Cumulative effects

9.6.17 The potential for fragmentation of bat flightlines by the Proposed Scheme and the proposed HS2 Phase One scheme are closely linked, as described above. In addition, it is possible that lighting along the access road on the northern boundary of the Greatmoor EfW facility could result in some light spillage into the Mega Ditch that could affect bats. As reported in the SES3 and AP4 ES, the operational lighting strategy for Greatmoor EfW facility is subject to approval via a planning condition. As a precaution, provision was made at the SES3 and AP4 ES for providing appropriate measures in the proposed HS2 Phase One scheme to avoid any light spillage into the Mega Ditch that would have the potential to result in disturbance of bat populations using the Mega Ditch as a flightline to move between roosts and foraging areas.

9.6.18 The combined effects from the operation of the Proposed Scheme, the HS2 Phase One scheme, the EWR2 upgrade and Greatmoor EfW facility have the potential to result in ongoing disturbance of the maternity colonies of Bechstein's and other woodland bat species associated with Sheephouse, Finemere and Romer and Greatsea woods. With the implementation of the proposed mitigation measures it is unlikely that there will be any cumulative effects on Bechstein's or other woodland bat species.

Other mitigation measures

9.6.19 The operational phase may result in potentially significant effects from nutrient nitrogen deposition on a small area of Sheephouse Wood SSSI due to emissions associated with FCC's existing fleet of waste haulage vehicles. However, it has been assumed that the existing waste trucks will either be renewed for lower emission vehicles or will cease to operate prior to operation through the application of controls via a planning condition for the Proposed Scheme. The associated reduction in emissions will remove the potentially significant effect on Sheephouse Wood SSSI.

9.6.20 A total of approximately 7ha of additional woodland planting will be provided in 2017 as part of the Proposed Scheme in order to compensate for the operational effects of the Proposed Scheme on bats. Once established, it will increase habitat connectivity in the area between Sheephouse, Romer and Greatsea woods and Finemere Wood. Along with the abundance of alternative roosting and foraging opportunities in the surrounding woodland areas, it is considered that the provision of these habitats would be sufficient to maintain the favourable conservation status of the populations within the assemblage and reduce the effects to a level that is not significant. New planting will address the potential for long-term adverse effects on the populations of bats in the Bernwood Forest from the combined operational effects of the Proposed Scheme, the HS2 Phase One scheme, the EWR2 upgrade and Greatmoor EfW, and includes:

- an approximately 4.35ha block of woodland planting that will provide improved habitat connectivity and foraging opportunities for the bat populations by connecting Romer Wood and Finemere Wood; and
- an area of approximately 2.1ha of planting to the south of Sheephouse Wood and along Three Points Lane that will shield roosts and flightlines in this area from operational light emissions. It will also strengthen the flightline along the southern edge of Sheephouse Wood to the Bridleway CAG/3 Underbridge.

9.6.21 The management of new planted woodlands will cover the establishment period and beyond to 50 years. The overall target is establishment of woodland that conforms to the Lowland Mixed Deciduous Woodland priority habitat type listed on Section 41 of the NERC Act 2006.

Summary of likely significant residual effects

9.6.22 No significant residual effects on ecological receptors are likely to occur as a consequence for operation of the Proposed Scheme.

10 Land quality

10.1 Introduction

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

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

10.1.3 The main environmental features of this area include:

- a number of small unnamed ponds within the boundary of the site and the Muxwell Brook that runs adjacent to the northwestern boundary of the site and flows generally north east to south west towards the River Ray;
- Finemere Wood and Sheephouse Wood SSSI;
- the underlying groundwater aquifer (the superficial Alluvium has been designated by the EA as a Secondary A aquifer).

10.1.4 The main land quality issues in this area include:

- a number of historical and current landfills within close proximity to the Proposed Scheme. Historical landfills include Calvert Pit 1, Aylesbury Borough Refuse Tip and Buckingham Rural District Council Refuse Tip. The restoration of Calvert landfill Pits 4 and 5 remain ongoing and Calvert landfill Pit 6 is accepting spoil and incinerator bottom ash from the Greatmoor EfW facility. An electrical substation is located on the south eastern boundary of Calvert landfill Pit 5;
- the Greatmoor EfW facility;
- the existing Aylesbury Link railway line; and
- clay deposits are present at the Calvert landfill Site to the southwest of the Proposed Scheme. Consent exists for an extended area of excavation within Calvert landfill Pit 6 which is currently being infilled.

10.1.5 Details of baseline information and the land quality assessment methodology are outlined in Volume 4.09: Environmental Statement Technical Appendix: Land quality impact assessment.

10.1.6 Land contamination issues are closely linked with those involving water resources. Issues regarding groundwater resources are addressed in Section 14, Water resources and Flood Risk.

10.2 Assessment methodology

Scope, assumptions and limitations

10.2.1 The assessment scope, key assumptions and limitations for the land quality assessment are as set out in the HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

Surveys/source of information

10.2.2 Information from site walkovers has been taken into account in the Land Quality section.

Study area

10.2.3 The land quality assessment will consider the application site and all land within 250m of the site boundary. This distance is normally applied for land quality desk studies when seeking to define the relevance of nearby potentially contaminated sites. This overall area is defined as the study area. With respect to groundwater, the study area extends to 1km outside the application site boundary.

10.2.4 The land quality assessment encompasses potentially contaminated land, mineral resources and geo-conservation areas.

10.3 Legislation and planning policy framework

10.3.1 The key planning policies relevant to the consideration of Land Quality include the National Planning Policy Framework Paragraphs 109, 120 and 121.

10.3.2 The Framework identifies that planning policies and decisions should ensure that:

- the site is suitable for its new use taking account of ground conditions and land stability, including from natural hazards or former activities such as mining, pollution arising from previous uses and any proposals for mitigation including land remediation or impacts on the natural environment arising from that remediation; and
- after remediation, as a minimum, land should not be capable of being determined as contaminated land under Part 2A of the Environmental Protection Act 1990.

10.4 Environmental baseline

Existing baseline

10.4.1 Unless otherwise stated, all features described in this section are presented in Map ES-17: Land Quality, in Volume 3 of this ES.

Geology

10.4.2 This section describes the underlying ground conditions within the study area. It first describes any made ground present, followed by near surface superficial deposits and lastly describes the deeper bedrock geology.

10.4.3 The geology underlying the study area is recorded on British Geological Survey (BGS) mapping. The mapping shows that there is an area of made ground within the western section of the study area that is associated with the clay pits, part of the wider Calvert landfill site. No other areas of made ground are identified on the geological mapping, though made ground will underlie the existing Aylesbury Link railway line and the Greatmoor EfW facility within the study area. Superficial drift deposits are absent from the majority of the study area, with the exception of a thin margin of Alluvium associated with Muxwell Brook running along the northwestern boundary of the site. The Alluvium comprises clays, silts, sands and gravel.

10.4.4 The bedrock geology underlying the study area consists of the Oxford Clay Formation, which is part of the Ancholme Group, composed of a succession of different mudstone members. Of these members, the majority of the study area is underlain by the Stewartby Member. The north western area is underlain by outcrops of the Peterborough Member, whereas the majority of the south eastern section of the study area is underlain by the Weymouth Member. A small area in the south eastern corner is underlain by an outcrop of West Walton Formation, which is also part of the Ancholme Group.

Groundwater

10.4.5 The Alluvium has been designated by the EA as a Secondary A aquifer. The Ancholme Group has been designated by the EA as Unproductive Strata.

10.4.6 The study area is not located within a groundwater Source Protection Zone (SPZ).

10.4.7 EA information indicates that there are no licensed abstractions for public water supply or other purposes within 1km of the application site.

Surface water

10.4.8 A number of small unnamed ponds are present within the boundary of the site. Muxwell Brook runs adjacent to the northwestern boundary of the site and flows generally north east to south west towards the River Ray. The water course is conveyed beneath the Aylesbury Link railway line via a culvert at the northwest corner of the site. A drain is marked running parallel to the immediate south of the Aylesbury Link railway line. An open body of water lies to the west of the site and within Calvert landfill Pit 6, being an expression of the former clay workings.

10.4.9 Information from the EA indicates that there are no surface water abstractions recorded within the study area.

Current and historical land use

10.4.10 The majority of the application site is currently agricultural land. In addition, the existing Aylesbury Link railway line which runs through the application site along the southwestern boundary.

10.4.11 Current potentially contaminative land uses within the study area include:

- the existing Aylesbury Link railway line;
- Calvert landfill Pit 6 (regulated under an Environmental Permit by the EA) to the southwest of the Proposed Scheme that is currently accepting spoil and incinerator bottom ash; and
- Greatmoor EfW facility.

10.4.12 Historical potentially contaminative land uses within the study area include:

- the existing Aylesbury Link railway line runs through the study area and has been present since at least 1899. A bridge with embankments either side is identified in the southern part of the study area crossing over the railway lines; and
- Calvert former clay pits (the current location of Calvert landfill Pit 6) are located adjacent to the north western corner of the site. These are associated with disused clay working areas. Clay extraction and brick making has been recorded in the area since the early 1900's. Planning permission for clay extraction from this location was granted in 1955.

Other regulatory data

10.4.13 Categories of regulatory data reviewed in the study area include pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences). Notable data is as follows:

- one active IPPC permit relating to the Calvert landfill site to the east of the Proposed Scheme;
- one Waste Management Licence registered to FCC Waste Services (UK) Ltd relating to the Calvert landfill site to the immediate east of the Proposed Scheme;
- one environmental permit registered to FCC Recycling (UK) Limited for the Greatmoor EfW facility; and
- two pollution incidents relating to the Calvert landfill site and therefore potentially located within the study area. The incidents are dated November 2002 and February 2003 and relate to containment and control failures. No information is available relating to significance or type of pollution incident.

Mining / mineral resources

10.4.14 The BCC Minerals and Waste Core Strategy Development Plan Document (November 2012) confirms that the study area is not located within a Minerals Consultation Area or Minerals Safeguarding Area or Preferred Area.

10.4.15 Clay deposits are present at the Calvert landfill site to the southwest of the Proposed Scheme. Historically, this material was an important resource used for the production of bricks at the site. Brickwork production ceased at the site in 1991. Consent exists for an extended area of excavation within Calvert landfill Pit 6 which is currently being infilled.

Geo-conservation resources

10.4.16 No geological conservation resources are identified within the study area.

Receptors

10.4.17 The sensitive receptors that have been identified within the study area are summarised in Table 7.

Table 7: Summary of Sensitive Receptors

Area Ref	**Receptor type**	**Receptor description**	**Receptor sensitivity**
Land Contamination	People	Residents at existing properties in the area surrounding the development.	High
		Workers e.g. on site and at nearby facilities such as nearby farms, railway and construction workers	Moderate
	Surface Water	On-site ponds	Moderate to high
		Muxwell Brook	Moderate to high
		Surface water culverts	Low to moderate
	Controlled Waters	Secondary A aquifer associated with the Alluvium deposits	Moderate
	Ecological	Finemere Wood and Sheephouse Wood SSSI	Moderate to high
	Built Environment	Buildings and properties	Low to high
		Underground structures and services e.g. water main	Low to moderate
Impacts on mining/mineral sites (isolation and sterilisation of mineral sites)	Mining/mineral sites	Clay deposits	Low to moderate

Future baseline

10.4.18 The future baseline assumes operation of the EWR2 upgrade, HS2 Phase One and the Proposed Scheme.

10.5 Effects arising during construction

Avoidance and mitigation measures

10.5.1 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction.

10.5.2 The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme and are expected to be compatible with any conditions to control contamination that may be imposed through the deemed planning permission. Its requirements in relation to work in contaminated areas will ensure the effective management and control of the work.

10.5.3 The draft CoCP requires that prior to and during construction, a programme of further investigations, which may include both desk based and site based work, will take place in order to confirm the full extent of areas of contamination and a risk assessment undertaken to determine what, if any, site specific remediation measures will be required to allow the Proposed Scheme to be constructed safely and to prevent harmful future migration of contaminants.

10.5.4 Where significant contamination is encountered, a remedial options appraisal will be undertaken to define the most appropriate remediation techniques.

10.5.5 Contaminated soils excavated from the site, wherever reasonably practicable, will be treated as necessary to remove or render any contamination inactive and reused within the Proposed Scheme where needed and suitable for use.

Assessment of impacts and effects

Land Contamination

10.5.6 The assessment methodology comprises the source-pathway-receptor model in which potential sources of contamination which may affect defined receptors via plausible pathways are identified, and changes in the model used to assess impacts of the Proposed Scheme at construction and post-construction stages. More detail is set out in the SMR, SMR Addendum and its appendices. An initial screening process was undertaken (identified in the methodology as Stages A and B) to identify areas of current or historical contaminative use within the study area and to consider which of these areas might pose contaminative risks for the Proposed Scheme. In total, three sites were considered during the screening process:

- GRS -1, Existing Aylesbury Link railway line;
- GRS -2, Calvert landfill Pit 6; and
- GRS -3; the Greatmoor EfW facility.

10.5.7 All three were taken forward to a more detailed risk assessment to assess potential risks more fully (Stages C and D). These areas assessed are shown on Map ES-17: Land Quality, in Volume 3 of this ES and are labelled with a reference number.

10.5.8 Conceptual site models (CSM) have been produced for the three sites taken to Stage C and D assessments which have been pre-screened as having some potential for impact. The detailed CSM are provided in Volume 4.09: Environmental Statement Technical Appendix: Land quality impact assessment. The results are summarised in this section. The following factors have determined the need for Stage C and D assessments:

- the proximity of the sites to the Proposed Scheme;
- the proximity of the sites to those areas of the Proposed Scheme where excavation works will occur;
- the presence of the underlying Secondary A aquifers or nearby watercourses; and
- the presence of adjacent properties or sensitive ecological receptors.

10.5.9 A summary of the baseline CSM is provided in Table 8. The impacts and baseline risks quoted are before any mitigation is applied. The assessed baseline risk is based on the information provided at the time of the assessment. Where limited information is available, it is based on precautionary, reasonable worst case assumptions and may therefore report a higher risk than that which actually exists.

10.5.10 The probability of there being a potential contaminative impact at any of the three sites (GRS1-GRS3) at baseline is considered to be unlikely.

Table 8: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area Ref	Area name	Main potential impacts	Main baseline risk
GRS -1	Existing Aylesbury Link railway line (within application site)	Risks to on-site human receptors (workers).	Low
		Risks to off-site human receptors (workers).	Low
		Risks to Secondary A Alluvium aquifer or surface water features.	Low
		Risks to off-site ecological receptors.	Very low
		Risks to built structures.	Very low
GRS -2	Calvert landfill Pit 6 – currently accepting spoil and incinerator bottom ash (off application site) in accordance with environmental permit and as regulated by the	Risks to on-site human receptors (workers).	Low
		Risks to Secondary A Alluvium aquifer or surface water features.	Low
		Risks to off-site ecological receptors.	Very low

Area Ref	Area name	Main potential impacts	Main baseline risk
	EA	Risk to built structures.	Low/moderate (gas) Very Low (direct contact)
GRS -3	Greatmoor EfW facility (off application site) operated in accordance with environmental permit and as regulated by the EA	Risks to on-site human receptors (workers).	Low
		Risks to off-site human receptors (workers).	Low
		Risks to Secondary A Alluvium aquifer or surface water features.	Low
		Risks to off-site ecological receptors.	Very low
		Risk to built structures.	Very low

Temporary effects

10.5.11 An assessment of the effects of contamination has been undertaken by comparing the CSM developed for potentially contaminated areas at baseline, construction and post construction stages. The baseline and construction CSM have been compared to assess effects at the construction stage.

10.5.12 Table 9 presents the summary of the construction effects obtained from a comparison of the baseline and construction impacts. The construction risk assessment takes into account the implementation of the mitigation measures set out within the draft CoCP. The details of these comparisons are presented in Volume 4.09: Environmental Statement Technical Appendix: Land quality impact assessment.

10.5.13 The baseline and construction CSM have been compared to determine the change in level of risk to receptors during the construction stage, and thus to define the level of effect at the construction stage. Where there is no change between the main baseline risk and the main construction risk, the temporary effect significance is deemed to be neutral regardless of the level of assessed risk. This also will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.

Table 9: Summary of temporary (construction) effects

Area Ref	Area name	Main baseline risks	Main construction risks	Temporary effect and significance
GRS -1	Existing Aylesbury Link railway line (within application site)	Very low to low	Very low to low/moderate	Minor adverse effect* (not significant)
GRS -2	Calvert landfill Pit 6 (off application site)	Very low to low/moderate	Very low to low/moderate	Neutral (not significant)
GRS -3	Greatmoor EfW facility (off application site)	Very low to low	Very low to low	Neutral (not significant)

*Minor adverse effect relates to 4 of 11 pollutant linkages summarised here.

10.5.14 Table 9 indicates that based upon the assessment, the construction stage is expected to have a neutral to minor adverse effect on the receptors overall. These effects are not considered to be significant in relation to potential land contamination.

10.5.15 Risks to receptors are considered to be potentially very low to low/moderate during construction of the Proposed Scheme. There may be a minor adverse effect on receptors from construction activities if contaminated material is encountered within the construction area. It is anticipated that this may only be the case in the vicinity of the existing Aylesbury Link railway line since this is the area most likely to be affected by construction of the Proposed Scheme. In accordance with the draft CoCP, ground investigations and risk assessments will be undertaken in advance of construction works commencing. Any contamination encountered will be remediated in accordance with the draft CoCP, including excavation and removal from the Proposed Scheme area if appropriate.

10.5.16 Sites located outside the Proposed Scheme are unlikely to be disturbed during construction and therefore impacts will be limited.

10.5.17 Construction compounds located in the area will include the storage of potentially hazardous substances, such as fuels and lubricating oils and may also be used for temporary storage of potentially contaminated soils. The measures outlined in the draft CoCP will manage risks from the storage of such materials.

Permanent effects

10.5.18 Baseline and post-construction CSM have been compared to assess the permanent (post construction) effects. The post-construction CSM assumes that all the required remediation has been carried out and validated.

10.5.19 Table 10 includes the summary of the permanent (post-construction) effects obtained from a comparison of the baseline and post-construction impacts and whether these are significant. The details of these comparisons are presented in Volume 4.09: Environmental Statement Technical Appendix: Land quality impact assessment.

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

Area Ref	Area name	Main baseline risks	Main post-construction risks	Post construction effect and significance
GRS -1	Existing Aylesbury Link railway line (within site)	Very low to low	Very low to low	Neutral (not significant)
GRS -2	Calvert landfill Pit 6 (off site)	Very low to low/moderate	Very low to low/moderate	Neutral (not significant)
GRS -3	Greatmoor EfW facility (off site)	Very low to low	Very low to low	Neutral (not significant)

10.5.20 The magnitude of the permanent effects and their significance has been determined by assessing the change in risk between the main baseline risk and the main post-construction risk. Therefore, where there is no change between the main baseline risk and the main post-construction risk, the permanent effect significance is deemed to be neutral. This will also be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.

10.5.21 The results of the assessment indicate that there will be an overall neutral effect, and none of the post-construction effects of land contamination impacts predicted are significant.

10.5.22 In the event that unexpected contamination is encountered during construction in this area, it will be remediated as described in the draft CoCP resulting in an overall beneficial effect.

Cumulative effects

10.5.23 There are anticipated to be no significant cumulative permanent effects.

Mining/mineral resources

10.5.24 Clay deposits are present at the Calvert landfill site to the southwest of the Proposed Scheme. Consent exists for an extended area of excavation within Calvert landfill Pit 6 to the south east of the existing pit, referred to as the Pit 6 Extension.

10.5.25 Extraction of these deposits will be subject to the landfill operator leaving sufficient stand-off between the edge of excavation and the existing Aylesbury Link railway line to ensure there is no ground movement within the vicinity of that railway, it is considered unlikely that construction or operation of the Proposed Scheme will impact on the ability to extract clay from the extended area within Pit 6, whether through sterilisation, direct excavation during construction or through temporary and/or permanent isolation.

Geo-conservation sites

10.5.26 No geological conservation resources are identified within the study area.

Other mitigation measures

10.5.27 The draft CoCP details the approach to managing potential land contamination matters. No additional mitigation measures are considered necessary to mitigate risks from land contamination at the construction stage beyond those set out in the draft CoCP, those defined in the Environmental Permit (held by the landfill and Greatmoor EfW facility operator) and those instigated as part of required remediation strategies.

Summary of likely significant residual effects

10.5.28 No likely significant adverse effects are anticipated with the application of the mitigation measures detailed in the draft CoCP, those defined in the Environmental Permit (held by the landfill and Greatmoor EfW operator) and those instigated as part of required remediation strategies.

10.6 Effects arising from operation

10.6.1 Users of the Proposed Scheme will at all routine times be within a controlled environment and have therefore been scoped out of the assessment.

Avoidance and mitigation measures

10.6.2 Maintenance and operation of the Proposed Scheme will be in accordance with environmental legislation and good practice whereby appropriate spillage and pollution response procedures will be established.

Assessment of impacts and effects

10.6.3 It is considered unlikely that the operation of the Proposed Scheme will give rise to any significant contamination. It is likely that only small volumes of chemicals (e.g. fuels and lubricants) will be held on the Proposed Scheme when operational. Provided these chemicals are stored and used in line with best practice (bunded areas, double skinned tanks etc.) there is no expectation that they will give rise to any significant contamination.

Temporary effects

10.6.4 No significant temporary effects are anticipated associated with the operation of the Proposed Scheme.

Permanent effects

10.6.5 No significant permanent effects are anticipated associated with the operation of the Proposed Scheme.

Cumulative effects

10.6.6 Environmental controls will be placed on operational procedures to minimise the potential for cumulative effects on land quality receptors. Maintenance and operation of the Proposed Scheme will be in accordance with environmental legislation and good practice e.g. appropriate spillage and pollution response procedures will be established.

10.6.7 No significant cumulative effects are anticipated associated with the operation of the Proposed Scheme.

Other mitigation measures

10.6.8 No other land quality mitigation measures beyond those already outlined are considered necessary within the Proposed Scheme.

10.6.9 If remediation works are required during construction, there will be on-going monitoring requirements, as appropriate, following their completion. Such monitoring, including monitoring of groundwater quality or ground gas, could extend into the operational stage of the Proposed Scheme.

Summary of likely significant residual effects

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

11 Landscape and visual

11.1 Introduction

11.1.1 This section reports the assessment of the landscape and visual effects of the Proposed Scheme. It summarises the baseline and future conditions found in and around the Proposed Scheme and describes the effects that will arise during construction and in years 1, 15 and 60 of operation of the Proposed Scheme on landscape character areas and visual receptors.

11.1.2 Temporary landscape and visual effects during construction will arise from the presence of construction plant, construction compounds, temporary access routes, earthworks, material stockpiles and lighting in the landscape and views. Effects will also arise from construction activity and traffic and from the removal of existing vegetation.

11.1.3 Permanent landscape and visual effects during operation will arise from the presence of altered landforms, new infrastructure elements (such as bridges, sidings and roads) and mitigation planting in the landscape and views.

11.1.4 A separate but related assessment of effects on the setting of heritage assets is included in Section 8 Cultural Heritage.

11.1.5 Only significant effects have been reported within this section. For details on non-significant effects, refer to Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment.

11.2 Assessment methodology

11.2.1 The assessment methodology used is based on the third edition of the Guidelines for Landscape and Visual Impact Assessment (GLVIA 3)[38]. It broadly follows the methodology set out in the HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

11.2.2 The assessment criteria used are set out in Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment.

Scope, assumptions and limitations

11.2.3 The baseline surveys and assessments were carried out from publically accessible land. During the surveys there were some areas (private land, commercial premises and residential properties) which were inaccessible. In these instances, professional judgement was used to approximate the likely views from these locations.

11.2.4 AVDC was contacted on 26th May 2016 regarding the location of viewpoints and photomontages. The landscape architect for AVDC commented on the specific viewpoints proposed for the assessment, saying that he was happy for the Landscape and Visual Assessment author to select these, and recommended the assessment of

[38] Landscape Institute and Institute of Environmental Management and Assessment, 2013

two further viewpoints: from Grendon Underwood and Doddershall House. These two viewpoints have therefore been included in the assessment.

Surveys/source of information

11.2.5 The site survey took place in April 2016 when most trees were still dormant, but some trees and hedgerow shrubs were just beginning to come into leaf.

Study area

11.2.6 The Zone of Theoretical Visibility (ZTV) of the Proposed Scheme (the area of land within which a development is theoretically visible during construction and operation) was modelled digitally. The ZTVs for construction and operation show that the scheme is unlikely to be visible beyond 2.8km of the boundary of the sidings site. The ZTVs were verified during the site survey and were used to establish the study area for the assessment. The ZTV is very similar to the ZTV modelled within the ES for the HS2 Phase One scheme within the study area[39].

11.3 Legislation and planning policy framework

11.3.1 National planning policy in relation to landscape is contained within the NPPF (Department of Communities and Local Government, 2012).

11.3.2 The NPPF sets out the Government's planning policies for England. The following policies are of relevance to this landscape and visual assessment:

- Policy 11. Conserving and Enhancing the Natural Environment - paragraph 109 notes that: the planning system should contribute to and enhance the natural and local environment by protecting and enhancing valued landscapes, geological conservation interests and soils ; and
- Policy 12. Conserving and Enhancing the Historic Environment - paragraph 128 notes that: in determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance.

11.4 Environmental baseline

Landscape baseline 2016

11.4.1 The study area is located within a gently undulating landscape with a number of distinct hills. Finemere Hill, Knowl Hill, Grange Hill, Spring Hill, Mill Hill and Dunsty Hill surround the Proposed Scheme. The character of the landscape is largely rural with settlement, including the villages of Grendon Underwood, Edgcott, Calvert, Middle Claydon, Shipton Lea and Quainton, generally dispersed. The land use is partly agricultural, with a mix of arable crops and pasture, and partly wooded, with large

[39] Further information on the methodology and approach for ZTV is included in the SMR and SMR addendum which can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information

areas of SSSI and ancient woodland, including Doddershall Wood, Grendon Wood, Finemere Wood and Sheephouse Wood. The landfill site at Calvert, the Grendon Young Offender Institution, Springhill Prison and Greatmoor EfW facility, are elements which contrast with the otherwise rural character of the area.

11.4.2 Finemerehill House and buildings at Lower Greatmoor Farm are the only listed structures in the study area and are detailed in Section 8 Cultural Heritage.

11.4.3 The Aylesbury Link railway line runs through the centre of the study area. A network of B roads connects the scattered settlements and farmsteads throughout the Waddesdon and Quainton area. Well-signposted PRoW cross the study area. These include:

- Bernwood Jubilee Way;
- Bridleway SCL/18, adjacent to the current sidings;
- Footpaths CAG 2, CAG 5/1 and GUN/25;
- Footpaths SCL 12/1, SCL 13/2, which cross the proposed HS2 route;
- Bridleways GUN28/1, GUN 31/2, GUN33/1, GUN 35/1 and Footpaths GUN 29/1, GUN30/1, and GUN34/1; and
- Bridleway QUA37/1 and QUA 36/1 and Footpath QUA 35/1.

11.4.4 For the purposes of this assessment, the study area is sub-divided into five discrete landscape character areas (LCA). These LCAs are based on the LCAs identified and described in the Aylesbury Vale Landscape Character Assessment[40]. Descriptions of all the LCAs are provided in Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment. Descriptions of those LCAs likely to be significantly affected by the Proposed Scheme are also provided below. The LCAs are shown on Map ES-20 in Volume 3: Environmental Statement Maps. The Proposed Scheme lies within the Kingswood Wooded Farmland LCA and there will be mitigation planting associated with the Proposed Scheme in the Finemere Hill LCA.

Kingswood Wooded Farmland LCA

11.4.5 This is an undulating landscape with a mix of pasture and arable land dispersed throughout the area. The landscape contains blocks of ancient woodland such as Grendon Wood and Doddershall Wood. These are remnants of the medieval Bernwood Royal Hunting Forest which, along with numerous mature hedgerow trees, give the landscape a wooded farmland character which is in good landscape condition. Despite the predominantly agricultural character of the area, tranquillity overall is considered medium due to the influence of the Aylesbury Link railway line, the Greatmoor EfW facility and the Calvert landfill site (in Calvert Clay Pits LCA). The character area is not dark at night. The Campaign to Protect Rural England (CPRE) assessment of radiance levels at night[41] indicates that the light levels on the existing

[40] Aylesbury Vale Landscape Character Assessment, prepared for Buckinghamshire County Council and Aylesbury Vale District Council, Jacobs (2008), Glasgow.
[41] http://nightblight.cpre.org.uk/maps/

railway sidings at Calvert are in the middle of the scale between low and high brightness levels, with the lower radiance levels further from the site, around Grendon Wood and Doddershall Wood. The village of Calvert, the Greatmoor EfW facility, Calvert landfill site and the Grendon Young Offender Institution and Springhill Prison are all lit at night and are sources of light intrusion. With the presence of PRoW, ancient woodland and the Grade II listed Lower Greatmoor Farm in the LCA, the area is valued at a regional level. The presence of the railway, Greatmoor EfW facility, Calvert landfill site and the Grendon Young Offender Institution and Springhill Prison (in the Poundon-Charndon Settled Hills LCA) detract from the otherwise rural character of the landscape, but this detracting effect is contained to a relatively small proportion of the LCA by its undulating topography and woodland. The LCA has a medium susceptibility to change of the type of development proposed (new sidings adjacent to the railway line) because the development is similar in nature to the type of development already present in the LCA. Overall, due to its good condition, regional value, medium tranquillity and medium susceptibility to change, this area is of high sensitivity.

Finemere Hill LCA

11.4.6 This is an undulating landscape with a mix of pasture and arable land generally dispersed throughout the area. Romer Wood, Greatsea Wood, Balmore Wood and Finemere Wood are ancient woodland giving the area a wooded farmland character, which is in good landscape condition. There are no roads in the LCA and this, along with the sense of seclusion created by the large areas of woodland, means that the LCA has a high level of tranquillity. The character area is relatively dark at night: the CPRE assessment of radiance shows levels in the LCA towards the lower end of the scale between dark and bright, but the assessment of radiance at Calvert Green, the Greatmoor EfW facility, Calvert landfill site and especially the Grendon Young Offender Institution and Springhill Prison are towards the brightest levels. Due to the extensive PRoW network, Finemere Wood SSSI and ancient woodland in the LCA, the area is valued at a regional level. The LCA has a high susceptibility to change of the type of development proposed because the LCA is predominantly rural. Overall, due to its good condition, regional value, high tranquillity and high susceptibility to change, this area is of high sensitivity

Claydon Bowl LCA

11.4.7 This LCA comprises a ridge of higher ground around the edges which slopes to lower ground in the centre to form a bowl. Located in the centre is Claydon House, a Grade II Registered Park and Garden. The area supports mixed farming and contains several ancient semi-natural woodlands, including Sheephouse Wood SSSI, which are surviving remnants of the medieval Bernwood Forest. The LCA generally has a strong hedgerow pattern that unifies the area. As a result the condition of the landscape is considered good. Tranquillity is high, due to a low level of settlement and relatively few through roads. The freight service (up to four trains a day) on the Bicester to Bletchley railway south of Steeple Claydon and the Aylesbury Link railway line to the southwest of the LCA is too occasional to affect tranquillity. The character area is relatively dark at night. The CPRE assessment of radiance levels shows low levels in the LCA. The landscape is associated with the Claydon House Estate and Parkland and is therefore valued at national level. The LCA has a high susceptibility to change of the type of development proposed because the LCA is predominantly rural. Overall, due

to its good condition, regional value, high tranquillity and high susceptibility to change, this area is of high sensitivity.

Visual baseline 2016

11.4.8 A summary description of the distribution and types of receptors most likely to be affected by the Proposed Scheme is provided below. The visual receptors identified during desk study and site survey are described in Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment, with photographs illustrating the existing view from representative viewpoints. The construction phase viewpoint locations are shown on Map ES-18 in Volume 3: Environmental Statement Maps.

11.4.9 Residential receptors have a high sensitivity to change. The Proposed Scheme will be most visible to a small number of residential receptors north-east of the Proposed Scheme at Finemerehill House and Knowlhill Farm. Although there are a number of other residential receptors in the study area, the undulating topography and woodland and other intervening vegetation means that it is unlikely that they will have a view of the Proposed Scheme in operation, though tall plant will be visible above the trees during construction. The Greatmoor EfW facility, which has a chimney approximately 52m high, and the Aylesbury Link railway line on embankment will largely screen the Proposed Scheme from receptors in residential properties on Lawn Hill and other locations to the west, south-west and south. There will be long views from the Grendon Young Offender Institution and Springhill Prison to the west, but again, the Proposed Scheme will be partially screened by the Greatmoor EfW facility and Aylesbury Link railway line.

11.4.10 Recreational receptors on the network of PRoW in the study area also have a high sensitivity to change and will have close views of the Proposed Scheme from the north-east and south-west. The PRoW affected include: Footpaths QUA/35/1, CAG/2/1 and GUN/31/1 and Bridleways QUA/36/2, GUN/25/2 and GUN/28/1.

11.4.11 People travelling on roads have a low sensitivity to change. Many of the surrounding roads are lined by trees and hedgerows or screened from the Proposed Scheme by local undulations in topography or the Greatmoor EfW facility and Aylesbury Link railway line embankment. Consequently the Proposed Scheme will be largely screened from receptors on local roads.

11.4.12 People at work have a low sensitivity to change as their attention is generally focused on their work activity. The screening effect of woodland, hedgerows, local undulations in topography, the Greatmoor EfW facility and the Aylesbury Link railway line embankment means that views of the Proposed Scheme will be largely restricted to agricultural workers in the fields north-west of the Proposed Scheme. Since these receptors are less sensitive than users of the PRoW and their views will be the same as those from the footpaths and bridleways in the area, they are included with recreational receptors in the assessment.

Future baseline

11.4.13 The future baseline assumes construction of the proposed HS2 Phase One scheme, on the southern side of the existing Aylesbury Link railway line, will be underway during construction of the Proposed Scheme (and will be completed by 2026). The proposed

EWR2 upgrade includes an upgrade to the existing Aylesbury Link railway line to enable passenger carriage. The EWR2 upgrade is assumed to be within the existing railway corridor extent and therefore will not affect the future baseline.

11.4.14 The consequential effect of committed developments on the character of LCAs and nature of views is described below.

Construction 2017

11.4.15 Construction of HS2 Phase One will result in a large-scale increase in the scale and extent of construction activity in the study area directly affecting not just the Kingwood Wooded Farmland and Finemere Hill LCAs, but also the Calvert Clay Pits and the Claydon Bowl LCAs. The construction footprint, the number of construction compounds, vehicles and plant and the extent of earthworks, fencing, temporary materials storage areas will be far larger than on the Proposed Scheme. Construction lighting on HS2 will increase light levels in the study area. This means that HS2 will be a strongly detracting element in the landscape and also will become a characteristic feature of the existing landscape in 2017. Consequently, the susceptibility of the landscape to the type of change resulting from the construction of the Proposed Scheme will be reduced, since the study area will already contain a substantial construction site and any additional construction will be seen in that context.

11.4.16 The building and chimney of the Greatmoor EfW facility form part of the existing (2016) landscape and visual baseline. The plant is lit by column street lights and the chimney is lit with aircraft warning lights.

11.4.17 No new visual receptors will be generated by the committed developments in 2017.

Operation 2019

11.4.18 Construction of the proposed HS2 Phase One scheme will be ongoing in 2019 and consequently the sensitivity of the LCAs will remain the same as predicted in the 2017 baseline. By 2019, hedgerow and woodland copse planting established as part of the landscape restoration masterplan for the Greatmoor EfW facility, illustrated on the Greatmoor Environmental Landscape Restoration Planting masterplan (GR3/1, June 2011, see Volume 4.01: Environmental Statement Technical Appendix: Additional information) will have established, increasing the woodland cover in the north of Kingswood Wooded Farmland LCA. This will however represent only a small increase within this well-wooded LCA and will not offset the far greater effects of the HS2 Phase One scheme in construction. The Greatmoor EfW facility building, at 52m, is so high that despite the increased woodland cover, it will remain the dominant feature in many views in 2019.

11.4.19 No new visual receptors will be generated by the committed developments in 2019.

11.4.20 The operational phase viewpoint locations are shown on Map ES-19 in Volume 3: Environmental Statement Maps.

11.5 Effects arising from construction

11.5.1 The elements of the Proposed Scheme which will give rise to impacts on landscape and visual receptors during construction include:

- removal of vegetation within the footprint of the Proposed Scheme and soil

stripping;

- construction of the operational sidings between Sheephouse Wood SSSI and Bridleway GUN/28;
- construction of the reception sidings between Bridleway GUN/28 and approximately 200m south-east of QUA/36/1 and QUA/36/3;
- construction of the Bridleway GUN/28 and Bridleway QUA/36 overbridges;
- realignment of the existing private access road from the A41 to the Greatmoor EfW facility and landfill site;
- construction site lighting and elevated noise and levels of activity altering the tranquillity of the area;
- temporary materials storage mounds, site compounds, temporary buildings, hardstanding and hoardings;
- fencing around the boundary; and
- woodland and hedgerow planting.

Avoidance and mitigation measures

11.5.2 As is commonplace with major infrastructure works, the scale of the construction activities means that works have the potential to give rise to significant effects which cannot be mitigated practicably. Such effects are temporary and vary over the construction period depending on the intensity and scale of the works at the time.

11.5.3 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction.

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

- retention of existing trees and vegetation where possible and protection of trees and vegetation to be retained;
- use of well-maintained site hoardings and fencing;
- designing lighting to avoid unnecessary intrusion onto adjacent properties and other land uses; and
- maintenance of planting and seeding works and implementation of management measures as landscape works are completed during the construction period.

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

Assessment of impacts and effects

11.5.6 The most apparent changes to landscape character and views during construction will result from the temporary presence of construction plant, the removal of existing landscape elements such as trees, hedges and agricultural land, the creation of embankments a maximum of 5m high, excavation of a cutting a maximum of 5m deep, the construction of the operational and reception sidings, the construction of the overbridges and the realignment of Greatmoor Road to the Greatmoor EfW facility and landfill site.

11.5.7 The construction works will be clearly apparent in locations in close proximity to the works, especially north-east of the sidings site. The works where visible will also be seen in the context of the HS2 Phase One scheme. The existing woodland and undulating topography of the study area will contain the effects of most low level construction activity from the wider landscape and views, especially the from the south-west, but the rail mounted gantry crane and tall plant will be apparent above the tree line over a wider area.

Landscape assessment

11.5.8 The following section describes the likely significant effects on LCAs during construction. All LCAs in the study area considered likely to experience non-significant effects are described in Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment. The LCA boundaries are shown on Map ES-20 in Volume 3: Environmental Statement Maps.

Kingswood Wooded Farmland LCA

11.5.9 The construction of the sidings, the Bridleway GUN/28 and QUA/36 overbridges and the realignment of the access road will take place at the northern end of the LCA. Impacts on the character of the area will result from the presence of construction plant, site accommodation, fencing, hard standing and temporary materials stockpiles in a largely rural landscape, though the Calvert landfill site, the Aylesbury Link railway line and the Greatmoor EfW facility immediately west of the site detract from the rural character of this part of the LCA.

11.5.10 Approximately 130m of hedgerow and four mature oak trees (10-15m high) growing within the footprint of the operational sidings will be removed. This will affect a key characteristic of the LCA - the historic field pattern, and a distinctive feature of the character area - trees within fields. Trees and scrub growing along the northern and southern embankments of the Aylesbury Link, on the embankments of the Bridleway GUN/28 overbridge and south of the bridge (around the realigned access road) will also be removed, reducing vegetation cover in the LCA. The works will be apparent in views of Finemere Hill from the southern part of the LCA, another distinctive feature of the character area. The following PRoW will be temporarily stopped up: Footpaths QUA/35/1, CAG/2/1 and GUN/31/1 and Bridleways QUA/36/2, GUN/25/2, GUN/28/1. The GUN/28 overbridge will be closed for 12 months during the overbridge widening.

11.5.11 Construction activity will introduce vehicles, disturbance and lighting into a rural area, reducing tranquillity for the duration of the works. Construction traffic moving materials will use a route through the Calvert landfill site from the Station Road

overbridge satellite compound. Construction workers will park close to the sidings site.

11.5.12 The works will affect a relatively small proportion of the LCA due to the screening effect of the Greatmoor EfW facility, the Aylesbury Link railway line and intervening vegetation; however they will be a prominent new element in a predominantly rural setting. Consequently the magnitude of change will be medium. The medium magnitude of change combined with the high sensitivity of the character area will result in a moderate adverse significant effect on the landscape character of the Kingswood Wooded Farmland LCA during construction.

Finemere Hill LCA

11.5.13 The construction of the sidings, the overbridges and the realignment of the access road will take place immediately south-west of the boundary of the LCA, in the Kingswood Wooded Farmland LCA. Mitigation planting associated with the Proposed Scheme will take place in the Finemere Hill LCA however. There will be no loss of woodland, scrub or hedgerow. Impacts on the character of the area will result from the presence of construction plant, site accommodation, fencing, hard standing and temporary materials stockpiles in a largely rural landscape, though the Aylesbury Link railway line and the Greatmoor EfW facility immediately south-west of the LCA detract from its rural character. The works will affect the PRoW network, a key characteristic of the LCA, with the closure of the GUN/28 overbridge (in the Kingswood Wooded Farmland LCA) for 12 months during the overbridge widening. The works will be apparent in views of Finemerehill House, a distinctive feature of the character area, affecting its landscape setting. Construction activity will introduce vehicles, disturbance and lighting into a rural area, reducing tranquillity for the duration of the works. Construction traffic moving materials will use a route through the Calvert landfill site from Station Road overbridge satellite compound and will not pass through the LCA.

11.5.14 The screening effect of Greatsea Wood, Romer Wood and Finemere Wood means that the works will affect a relatively small proportion of the LCA. They will also be seen in the context of the Greatmoor EfW facility immediately to the south-west. However, they will result in a noticeable change to the rural character and setting of the area where they are apparent. Consequently the magnitude of change will be medium. The medium magnitude of change combined with the high sensitivity of the character area will result in a moderate adverse significant effect on the landscape character of the Finemere Hill LCA during construction.

Claydon Bowl LCA

11.5.15 The construction of the sidings, the construction of the overbridges and the realignment of the access road will take place immediately south of the LCA boundary. There will be no direct effect on the LCA and therefore no loss of woodland, scrub, hedgerow or farmland. Impacts on the character of the area will result from the presence of construction plant, site accommodation, fencing, hard standing and temporary materials stockpiles in a largely rural landscape, though the Calvert landfill site, the Aylesbury Link railway line and the Greatmoor EfW facility south of the LCA detract from its rural character. The works will affect the PRoW network, with the closure GUN/28 overbridge (in the Kingswood Wooded Farmland LCA) for 12 months during the overbridge widening.

11.5.16 The setting of the Claydon House Registered Park and Garden will not be affected due to its distance from the construction works and the screening effect of the intervening topography and vegetation. Construction activity will introduce vehicles, disturbance and lighting into a rural area, reducing tranquillity for the duration of the works. Construction traffic moving materials will use a route through the Calvert landfill site from Station Road overbridge satellite compound and will not pass through the LCA.

11.5.17 Sheephouse Wood, Home Wood and Romer Wood will screen the works from the wider LCA and consequently only a relatively small proportion of the LCA will be affected. However, they will result in a noticeable change to the rural character and setting of the area where they are apparent. Consequently the magnitude of change will be medium. The medium magnitude of change combined with the high sensitivity of the character area will result in a moderate adverse significant effect on the landscape character of the Claydon Bowl LCA during construction.

Visual Assessment

11.5.18 The following section describes the likely significant effects on visual receptors during construction. All receptors in the study area considered likely to experience non-significant effects are described in Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment. The ZTV of the Proposed Scheme during construction and the viewpoint locations are shown on Map ES-18 in Volume 3: Environmental Statement Maps. In each case, the middle number of the viewpoint (xxx.x.xxx) identifies the type of receptor that is present in the area: 2 - Residential, 3 - Recreational or 4 - Transport. Where a viewpoint represents multiple types of receptor, the assessment is based on the most sensitive receptor. Effects on other receptor types with a lower sensitivity may be lower than reported.

Viewpoint 146.2.001: View west from Finemerehill House

11.5.19 The construction works on the GUN/28 and QUA/36 overbridges and the reception and operational sidings, a minimum of 600m away, will be clearly visible from Finemerehill House. Removal of vegetation from within the footprint of the Proposed Scheme will open up views of the Aylesbury Link railway line. Due to the elevated position of the viewpoint, construction activity and plant, the satellite construction site and temporary material stockpiles will be prominent in the panorama of the agricultural landscape. Construction works will introduce new features into the view, but they will be seen in the context of existing industrial and urban features including the Greatmoor EfW facility, the Calvert landfill site, the Grendon Young Offender Institution and Springhill Prison, the Aylesbury Link railway line and large-scale agricultural buildings. The magnitude of change will be medium.

11.5.20 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 146.3.002: View south-west along Footpath GUN28/1 and from the Claydon Woods Circular Walk (Bridleway GUN/33/1 and GUN/33/2) between Sheephouse Wood and Greatsea Wood

11.5.21 The construction works on the GUN/28 and QUA/36 overbridges and the operational and reception sidings, a minimum of 400m away, will be clearly visible from a few locations along the footpath and bridleway. Most views of construction however, will

be filtered through vegetation lining the footpath and bridleway. Construction activity and plant, the satellite construction site and temporary material stockpiles will be new features in the view, but they will be seen in the context of the Greatmoor EfW facility which is prominent in the background. The magnitude of change will be medium.

11.5.22 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 148.2.001: View south-west from Knowlhill Farm

11.5.23 The construction works on the GUN/28 and QUA/36 overbridges and the reception and operational sidings, a minimum of 900m away, will be visible from Knowlhill Farm, though the south-eastern edge of Sheephouse Wood will screen part of the operational sidings site. Removal of vegetation from within the footprint of the Proposed Scheme will open up views of the Aylesbury Link railway line. Due to the elevated position of the viewpoint, construction activity and plant, the satellite construction site and temporary material stockpiles will be prominent in the panorama of the agricultural landscape. Construction will introduce new features into the view, but they will be seen in the context of existing industrial and urban features including the Greatmoor EfW facility, the Aylesbury Link railway line and large-scale agricultural buildings. The magnitude of change will be medium.

11.5.24 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

Cumulative effects 2017-2019

11.5.25 The cumulative effects resulting from additional changes to the landscape or views caused by the Proposed Scheme in conjunction with these committed developments are described below. The future baseline assumes the construction of HS2 Phase One and the proposed EWR2 upgrade will be underway during construction of the Proposed Scheme in 2017 - 2019. The EWR2 upgrade is relatively small in comparison with the HS2 Phase One scheme however and is unlikely to give rise to cumulative effects. The EWR2 upgrade and HS2 Phase One will be constructed adjacent to the Proposed Scheme.

11.5.26 The consequential effect of committed developments on the character of LCAs and nature of views is described below.

Landscape assessment

11.5.27 The proposed HS2 Phase One scheme will result in large-scale changes to the Kingswood Wooded Farmland, the Calvert Clay Pits and the Claydon Bowl LCAs due to removal of vegetation and the construction of infrastructure, earthworks, cuttings, overbridges and the Sheephouse Wood mitigation structure, affecting the rural setting of the LCAs. The construction of the Proposed Scheme will result in a relatively small increase in the scale of the works taking place in the study area, when compared with the HS2 and works. The Proposed Scheme will result in the addition of new features to the landscape but they will be largely inconspicuous in the context of the much larger HS2 Phase One scheme. Therefore there will be no significant cumulative adverse effects on these LCAs arising from construction of the Proposed Scheme.

11.5.28 The HS2 Phase One scheme will result in changes to the Finemere Hill and the Poundon-Charndon Settled Hills LCAs due to the intervisibility of construction plant in adjoining LCAs affecting the rural setting of the LCAs. The construction plant of the Proposed Scheme will be largely inconspicuous in the context of the much larger HS2 scheme. Therefore there will be no significant cumulative adverse effects on these LCAs arising from construction of the Proposed Scheme.

Visual assessment

11.5.29 The scale of the HS2 Phase One scheme in construction means that it will dominate most views in the study area and will partially screen views of the Proposed Scheme construction works from the north, west and south. The Proposed Scheme will be seen from the east, but in the context of the much larger HS2 works. Where construction of the Greatmoor Railway Sidings is visible, the works will generally appear to be part of the HS2 Phase One scheme. There will be no significant cumulative adverse effects on views arising from construction of the Proposed Scheme.

Other mitigation measures

11.5.30 No other mitigation measures are considered practicable during construction.

Summary of likely significant residual effects

11.5.31 There will be moderate adverse significant effects during construction on landscape character in the following LCAs:

- Kingswood Wooded Farmland LCA;
- Finemere Hill LCA; and
- Claydon Bowl LCA.

11.5.32 There will be moderate adverse significant effects during construction on:

- Viewpoint 146.2.001: View west from Finemerehill House;
- Viewpoint 146.3.002: View south-west along Footpath GUN28/1 and from the Claydon Woods Circular Walk (Bridleway GUN/33/1 and GUN/33/2) between Sheephouse Wood and Greatsea Wood; and
- Viewpoint 148.2.001: View south-west from Knowlhill Farm.

11.6 Effects arising from operation

11.6.1 The elements of the Proposed Scheme which will give rise to impacts on landscape and visual receptors during operation include:

- loss of trees, woodland, scrub and hedgerows;
- the operational sidings, occupying a footprint (including earthworks) around 75m wide and 600m long and on a 5m high embankment between Sheephouse Wood SSSI and Bridleway GUN/28;
- the 22.4m high rail mounted gantry crane at the operational sidings;

- the reception sidings, occupying a footprint (including earthworks) around 20m wide and 800m long and in a 5m deep cutting embankment between the Bridleway GUN/28 and Bridleway QUA/36 overbridges;
- the Bridleway GUN/28 accommodation green overbridge, which will be approximately 48m wide and 10m high to top of parapet level and 11.5m high to top of soil level. The bridge will be vegetated with grass and native species scrub planting;
- the Bridleway QUA/36 accommodation green overbridge which will be approximately 35m wide and 10m high to top of parapet level and 11.5m high to top of soil level The bridge will be vegetated with grass and native species scrub planting;
- the realigned private access road from the A41 to the Greatmoor EfW facility and Calvert landfill site;
- office and welfare facilities adjacent to the operational sidings and the widened over bridge;
- landscape and ecological mitigation planting north-east and south-west of the Proposed Scheme;
- security fencing; and
- lighting: the rail mounted gantry crane will be lit at gantry level; the Bridleway GUN/28 accommodation green overbridge access road will be lit by bollards; and the sidings will be lit by 10m high lamp columns.

Avoidance and mitigation measures

11.6.2 The operational assessment of impacts and effects is based on year 1 (2020), year 15 (2035) and year 60 (2080) of the Proposed Scheme. A process of iterative design and assessment has been employed to avoid or reduce adverse effects during operation (refer to Map ES-06 in Volume 3: Environmental Statement Maps). Measures that have been incorporated into the design include:

- new woodland will be planted in the field south of Romer Wood and Greatsea Wood. This will reinforce a key characteristic of the Finemere Hill LCA and reduce landscape impacts on the LCA and visual impacts on receptors at Finemerehill House and on Footpath GUN/31/2;
- new woodland and native hedgerow and woodland edge species will be planted along the Bridleways GUN/33/1 and GUN/28/1 and along the boundary of a field between Footpath GUN/31/1 and Bridleway GUN/28/1. This will reduce landscape impacts on the Kingswood Wooded Farmland LCA, the Finemere Hill LCA and the Claydon Bowl LCA. The planting will reduce visual impacts on receptors at Finemere Hill House and on Bridleways GUN/33/1 and GUN/28/1 and on Footpath GUN/30/1; and
- woodland planting south of the realigned access road. This will reduce landscape impacts on the Kingswood Wooded Farmland LCA.

11.6.3 A phased landscape restoration masterplan has been produced for the Greatmoor EfW facility and wider landfills (see the Greatmoor Environmental Landscape Restoration Planting masterplan (GR3/1, June 2011, see Volume 4.01: Environmental Statement Technical Appendix: Additional information)). This implements extensive woodland and scrub planting on the Greatmoor EfW facility site that will contribute to the screening of the Proposed Scheme from the south, west and north.

11.6.4 Due to the environmental sensitivities in the area (i.e. the presence of bats), the hours of operation and the use of external lights for the unloading and loading of trains will be restricted from March through to October inclusive, to avoid disturbance from light and noise. Trains will, however, be able to arrive and depart at any time (including the night). The sidings will potentially be lit between 0500 and 2300 during hours of darkness in the winter months (November to February) but for shorter hours during the rest of the year, when the bats are active. Further details on lighting hours are contained within the report on "Operational Timing Restrictions to Minimise Effects on Bats", June 2016 (refer to Volume 4.01: Environmental Statement Technical Appendix: Additional information).

Assessment of impacts and effects

11.6.5 The most apparent changes to landscape character and views during operation will arise from the presence of new engineered landforms in the existing undulating landscape and the introduction of large infrastructure elements into a rural environment, including the operational and reception sidings, the rail mounted gantry crane and the two green accommodation overbridges. The Proposed Scheme, where visible, will be seen in the context of the HS2 Phase One scheme.

11.6.6 The local topography, existing woodland and the substantial Greatmoor EfW facility will contain landscape and visual effects to a relatively small area around the Proposed Scheme. Effects will be reduced over time as mitigation planting becomes established.

Landscape assessment

11.6.7 All the LCAs in the study area are considered likely to experience non-significant effects on landscape character: these are described in Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment. The LCA boundaries are shown on Map ES-20: Landscape Character Areas in Volume 3: Environmental Statement Maps.

Visual Assessment

11.6.8 The following section describes the likely significant effects on visual receptors during operation. All receptors in the study area considered likely to experience non-significant effects are described in Volume 4.10: Environmental Statement Technical Appendix: Landscape and visual impact assessment. The ZTV of the Proposed Scheme during operation and the viewpoint locations are shown on Map ES-19 Operation Phase Viewpoints and ZTV in Volume 3: Environmental Statement Maps.

Viewpoint 146.2.001: View west from Finemerehill House

11.6.9 The overbridges, the rail mounted gantry crane, the reception sidings, the operational sidings and the office and welfare facilities, a minimum of 600m away, will be clearly visible from Finemerehill House. The bridge, rail mounted gantry crane and sidings will be new features in the view, but they will be seen in the context of existing industrial, infrastructure and urban features including the Greatmoor EfW facility, the Calvert landfill site, the Grendon Young Offender Institution and Springhill Prison, the Aylesbury Link railway line and large-scale agricultural buildings. The sidings will occupy a relatively narrow horizontal strip of the view. The magnitude of change will be medium in year 1 of operation.

11.6.10 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in year 1 of operation which is significant.

11.6.11 By year 15, the new woodland planting south of Romer Wood and Greatsea Wood, along Bridleway GUN28/1 and between Footpath GUN/31/1 and scrub planting on the overbridges will have established. The reception sidings will be largely screened from view and views of the operational sidings, overbridge and rail mounted gantry crane will be partly filtered. The magnitude of change will reduce to low. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse non-significant effect by year 15 of operation.

11.6.12 Lighting on the sidings and the rail mounted gantry crane will be perceptible against a baseline view featuring existing lighting from the Greatmoor EfW facility and Grendon Young Offender Institution and Springhill Prison. The magnitude of change to this receptor at night will be low, resulting in minor adverse, non-significant effects.

11.6.13 Photomontages illustrating the view from Finemerehill House during years 1 and 15 of operation are shown on Maps ES-21 and Es-22 in Volume 3: Environmental Statement Maps.

Viewpoint 146.3.002: View south-west along Footpath GUN28/1 and from the Claydon Woods Circular Walk (Bridleway GUN/33/1 and GUN/33/2) between Sheephouse Wood and Greatsea Wood

11.6.14 The overbridges, the rail mounted gantry crane, the office and welfare facilities, the reception sidings and the operational sidings, a minimum of 400m away, will be clearly visible from a few locations along the footpath and bridleway. Most views of the Proposed Scheme however, will be filtered through vegetation lining the footpath and bridleway. The structures will be new features in the view, but they will be seen in the context of the Greatmoor EfW facility which is prominent in the background. The magnitude of change will be medium in year 1 of operation.

11.6.15 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in year 1 of operation which is significant.

11.6.16 By year 15, the new woodland planting along Bridleway GUN28/1 and between Footpath GUN/31/1 and scrub planting on the overbridges will have established. The

sidings, overbridges and rail mounted gantry crane will be largely screened from view. The magnitude of change will reduce to low. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse non-significant effect by year 15 of operation.

11.6.17 Lighting on the sidings and the rail mounted gantry crane will be perceptible against a baseline view featuring existing lighting from the Greatmoor EfW facility. The magnitude of change to this receptor at night will be low, resulting in minor adverse, non-significant effects.

11.6.18 Photomontages illustrating the view from Footpath GUN28/1 and from the Claydon Woods Circular Walk during years 1 and 15 of operation are shown in Map ES-24 in Volume 3: Environmental Statement Maps.

Viewpoint 146.3.005: View north-west and south-east from the bridge over the Aylesbury Link railway line (Footpath GUN 28)

11.6.19 The operational sidings, office and welfare facilities and rail mounted gantry crane will be visible in the foreground and middle ground. The reception sidings, the widened access road and the Bridleway QUA/36 overbridge will occupy the foreground and middle ground of views south-east. The structures will increase the proportion of the view occupied by transport infrastructure, but they will be seen in the context of the existing railway line, the Greatmoor EfW facility and the Calvert landfill site. They will therefore be largely characteristic new features of the existing view. The magnitude of change will be medium in year 1 of operation.

11.6.20 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in year 1 of operation which is significant.

11.6.21 By year 15 and beyond, the mitigation planting on the embankments of the Bridleway GUN/28 overbridge, the Bridleway QUA/36 overbridge and adjacent to the realigned access road will have matured. The sidings and rail mounted gantry crane will remain visible but views will be partly filtered. The magnitude of change will reduce to low. The low magnitude of change combined with the high sensitivity of the receptors will result in a minor adverse non-significant effect by year 15 of operation.

11.6.22 Lighting on the sidings and the rail mounted gantry crane will be perceptible against a baseline view featuring existing lighting from the Greatmoor EfW facility and the Calvert landfill site. The magnitude of change to this receptor at night will be low, resulting in minor adverse, non-significant effects.

Cumulative effects 2019 onwards

11.6.23 The cumulative effects resulting from additional changes to the landscape or views caused by the Proposed Scheme in conjunction with committed developments are described below. The EWR2 upgrade will increase capacity on the line as it allows passenger trains in addition to freight trains. However, the anticipated service pattern on the line (1 passenger train per hour each way) is unlikely to give rise to cumulative effects. Construction of the HS2 Phase One scheme and the EWR2 upgrade will be ongoing in 2019, with the EWR2 upgrade finishing in 2022 and HS2 Phase One scheme finishing in 2026.

Landscape assessment

11.6.24 The HS2 Phase One scheme will be under construction during the first six years of operation of the Proposed Scheme. It will continue to result in large-scale changes to the Kingswood Wooded Farmland, The Calvert Clay Pits and the Claydon Bowl LCAs due to the construction of infrastructure, earthworks, cuttings and the Sheephouse Wood mitigation structure, affecting the rural setting of the LCAs. The operation of the Greatmoor Railway Sidings will introduce new structures into the landscape but they will be largely inconspicuous in the context of the much larger HS2 Phase One scheme under construction. Therefore there will be no significant cumulative adverse effects on landscape character in these LCAs arising from construction of the Proposed Scheme.

11.6.25 The HS2 Phase One scheme will result in changes to the Finemere Hill and the Poundon-Charndon Settled Hills LCAs due to the intervisibility of construction plant in adjoining LCAs affecting the rural setting of the LCAs. The Proposed Scheme in operation will be largely inconspicuous in the context of the much larger HS2 Phase One scheme. Therefore there will be no significant cumulative adverse effects on landscape character in these LCAs arising from construction of the Proposed Scheme.

Visual assessment

11.6.26 The scale of the HS2 Phase One scheme in construction means that it will dominate most views in the study area and will partially screen views of the new overbridges from the north, west and south. The sidings and overbridges will be seen from the east, but in the context of the large-scale HS2 construction works. There will be no significant cumulative adverse effects on views arising from construction of the Proposed Scheme.

Other mitigation measures

11.6.27 The permanent effects of the Proposed Scheme on landscape and visual receptors have been substantially reduced through incorporation of the measures described above. Effects by year 1 of operation may be further reduced by establishing planting early in the construction programme, which will be considered during the detail design stage. This would provide additional screening and greater integration of the Proposed Scheme into the landscape.

Summary of likely significant residual effects

11.6.28 There will be no significant effects on landscape character in the LCAs during operation.

11.6.29 There will be significant effects on the following viewpoints during operation:

- Viewpoint 146.2.001: View west from Finemerehill House. Significant effects are likely during year 1 of operation. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse non-significant effect by year 15 of operation;
- Viewpoint 146.3.002: View south-west along Footpath GUN28/1 and from the Claydon Woods Circular Walk (Bridleway GUN/33/1 and GUN/33/2) between Sheephouse Wood and Greatsea Wood. Significant effects are likely during

year 1 of operation. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse non-significant effect by year 15 of operation; and

- Viewpoint 146.3.005: View north-west and south-east from the bridge over the Aylesbury Link railway line (Footpath GUN 28). Significant effects are likely during year 1 of operation. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse non-significant effect by year 15 of operation.

12 Sound, noise and vibration

12.1 Introduction

12.1.1 This section of the report sets out the approach for assessing the likely significant effects of sound, noise and vibration from construction and operation of the Proposed Scheme.

12.1.2 This section reports the temporary effects which are likely to occur from construction groundborne sound, noise and vibration and airborne sound; as well as the permanent effects from operational airborne sound.

12.1.3 It has been assumed that operational haulage routes will be provided with standard smooth road surface free from bumps and irregularities such that there is no potential for operational effects due to groundborne noise and vibration from vehicle movements. The effects from operational groundborne noise and vibration and operational indirect effects have therefore been scoped out of the assessment.

12.2 Assessment methodology

Construction

12.2.1 Direct effects from activities, other than earth moving operations, and indirect effects from road traffic associated with construction of the Proposed Scheme have been assessed according to the assessment scope, key assumptions and limitations for the construction sound, noise and vibration assessment as set out in the HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information

12.2.2 Construction road traffic associated with the construction phases of the Proposed Scheme would generate airborne noise. Based upon the predicted traffic numbers reported in Section 13, Traffic and transport, a change in noise levels for any given road as a result of the presence of construction traffic has been predicted at a reference distance of 10m from the edge of nearside carriageway. The results of this are given in Table 14.

Operation

Fixed plant noise emissions

12.2.3 The airborne sound generated by stationary operational plant is calculated using the method set out in BS4142:2014[42]. The assessment methodology for stationary systems is described in the HS2 Phase One ES, Volume 5, Appendix SV-001-000: Sound, noise and vibration: methodology, assumptions and assessment (route-wide), Annex E[43].

[42] BS4142:2014 Methods for rating and assessing industrial and commercial sound
[43] http://webarchive.nationalarchives.gov.uk/20140810181503/http://assets.dft.gov.uk/hs2-environmental-statement/volume-5/sound/Vol5_Appendix_SV-001-000.pdf

12.2.4 For the purpose of this assessment the following items are considered within the fixed plant noise emissions assessment:

- excavator;
- rail mounted gantry crane; and
- all other fixed mechanical and electrical plant equipment

12.2.5 Operational activities in the sidings will be restricted to certain hours in order to limit the impacts on local bat populations and as such operating times for the excavator and rail mounted gantry crane will be variable across the year. Operating times are contained within the report on "Operational Timing Restrictions to Minimise Effects on Bats", June 2016(refer to Volume 4.01: Environmental Statement Technical Appendix: Additional information). The reasonable worst case operating hours used in the assessment are during the winter months when operations are unrestricted from 0500 until 2300.

Onsite vehicular movements

12.2.6 The sources of airborne sound for vehicular movements during the operation of the onsite operator's haulage routes are similar in nature to those found on a construction site. Therefore the source data from BS 5228-1:2009[44] are considered to be reasonable for use in the calculation of operational airborne noise emissions.

12.2.7 Day time and night time noise levels from onsite vehicles and rail movements associated with the operation of the existing railway sidings at Calvert have been calculated using Noisemap acoustic modelling software.

12.2.8 Airborne noise emissions from vehicular movements are assessed in accordance with the methodology set out in HS2 Phase One ES, Volume 5, Appendix SV-001-000: Sound, noise and vibration: methodology, assumptions and assessment (route-wide), Annex A.

12.2.9 Onsite vehicular operating hours are restricted during certain times of the year in order to protect local bat populations. The worst case operating hours for onsite vehicles are from 0500 until 2300 during the winter months.

Surveys/source of information

Construction

12.2.10 The overall approach to baseline data collection for sound noise and vibration is described in the HS2 Phase One ES, Volume 5, Appendix SV-001-000: Sound, noise and vibration: methodology, assumptions and assessment (route-wide).

12.2.11 In the area surrounding the Proposed Scheme, long-term baseline sound measurements (unattended measurements of at least 24 hours duration) have been undertaken at two measurement location.

[44] BS 5228-1:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites. Noise

12.2.12 A long term measurement has been carried out at Oak Tree Farm (measurement location CS0080) approximately 1km south of the site, but with a similar isolated rural sound environment.

12.2.13 An additional long term measurement has been carried out to establish new baseline sound levels at Lower Greatmoor Farm, given that the baseline measurements obtained for the HS2 Phase One ES were undertaken before the commencement of operation of the Greatmoor EfW facility.

12.2.14 Ordnance Survey (OS) address point data has been used to gather the list of potential receptors within the spatial scope of the assessment. Potential sensitive receptors include dwellings at Lower Greatmoor Farm and Finemerehill House. Offices in the Greatmoor EfW facility are not considered to be noise sensitive due to the inherent nature of the facility which generates noise (from mechanical plant and heavy goods vehicles).

12.2.15 The following relevant details have been included in the assessment for the main construction activities:

- mechanical plant and equipment types;
- numbers of items of equipment;
- percentage on-times for relevant assessment time periods;
- activity working hours;
- programme; and
- site plans illustrating working and compound locations.

Operation

12.2.16 Baseline sound levels were determined for the HS2 Phase One ES, and have primarily been used as the basis of this assessment. An additional survey has been carried out to establish new baseline sound levels at Lower Greatmoor Farm, given that the baseline measurements obtained for the HS2 Phase One ES were undertaken before the commencement of operation of the Greatmoor EfW facility. The approach to baseline data collection for sound, noise and vibration is described in HS2 Phase One ES, Volume 5: Appendix SV-001-000 Sound, noise and vibration: methodology, assumptions and assessment (route-wide).

Study area

12.2.17 The spatial scope for the assessment of direct effects from construction is defined as follows (from BS5228-1[45]):

- 300m from any construction activity or the area within which sound levels from the Proposed Scheme are forecast to give rise to potential impacts, whichever is the greater.

[45] BS5228-1 2009+A1:2014 - Code of practice for noise and vibration control on construction and open sites. British Standards Institution.

12.2.18 A quantitative assessment of direct effects from construction ground borne vibration has been undertaken for all receptors within the following areas:

- residential and non-residential receptors (except as defined below) - whichever is the greater of either 85m from the nearest construction activity with the potential to cause noticeable vibration or the area within which impacts from ground-borne sound and/or vibration from the Proposed Scheme are forecast; and
- non-residential receptors / land uses where low ambient vibration or sound is critical to operations, for example, very sensitive laboratory equipment such as nanotechnology laboratories, sound recording / broadcast studios, large auditoria / theatres or concert halls - 200m from the nearest construction activity.

12.2.19 The spatial scope for indirect effects from construction covers roads where a quantitative assessment has shown the increase or decrease in road traffic volumes or traffic types caused by the Proposed Scheme would be likely to cause a change in the baseline sound level ($L_{pAeq,T}$) exceeding 1 dB during either the day (07:00 to 23:00) or night time periods (23:00 to 07:00).

12.2.20 The spatial scope for direct effects from operational sound is defined as 1km from any operational activity or the area within which sound levels from the Proposed Scheme are forecast to give rise to potential impacts, whichever is the greater.

12.2.21 Assessment locations are shown in Maps ES-25: Assessment and Monitoring Locations for Construction Sound, Noise & Vibration Assessments and ES-26: Assessment and Monitoring Locations for Operational Sound, Noise & Vibration Assessments in Volume 3 of this ES.

12.3 Legislation and planning policy framework

12.3.1 The key planning policies relevant to the consideration of sound, noise and vibration impact are contained in the National Planning Policy Framework[46].

12.3.2 The approach adopted for the assessment of sound, noise and vibration is as described in the HS2 Phase One ES Volume 5: Appendix SV-001-000 Sound, noise and vibration: methodology, assumptions and assessment (route-wide), Annex A and Annex E; this also contains further information regarding the above national policy information and how this relates to the approach.

12.4 Environmental baseline

12.4.1 The assessment of noise from construction and operational activities assumes a baseline which represents the period immediately prior to the start of the construction or operational period.

[46] Department for Communities and Local Government (DCLG) (2012), National Planning Policy Framework.

12.4.2 Baseline sound levels have been determined for those receptors within the spatial scope during the HS2 Phase One ES, and will be primarily be used as the basis of this assessment.

12.4.3 In addition to this, updated baseline information has been obtained at Lower Greatmoor Farm in order to account for noise sources associated with the Greatmoor EfW facility which were not accounted for in the HS2 Phase One ES baseline information.

Existing baseline

12.4.4 Existing baseline sound levels (2016) have been ascertained for each assessment location within this area for use in both construction and operational assessments. These levels are presented in terms of the following key sound indicators:

- $L_{pAeq,16hr\ weekday}$ daytime (07:00-23:00) sound pressure level;
- $L_{pAeq,8hr\ weekday}$ night-time (23:00-07:00) sound pressure level;
- arithmetic average of $L_{pAFmax,5min}$ night-time sound pressure level;
- highest $L_{pAFmax,5min}$ night-time sound pressure level;
- daytime L_{pAeq} sound pressure level (Monday to Friday 07:00-19:00; Saturday 07:00- 13:00);
- evening/weekend L_{pAeq} sound pressure level (Monday to Friday 19:00-23:00; Saturday 13:00- 23:00; Sunday 07:00-23:00); and
- night-time L_{pAeq} sound pressure level (Monday to Sunday 23:00-07:00).

12.4.5 The values relevant to the construction assessment are presented in Table 11 and the values relevant to the operational assessment are presented in Table 12. The data source coding included within this table details how the baseline sound levels allocated to each assessment location have been derived.

12.4.6 In summary, the existing baseline sound levels presented for assessment locations (other than Lower Greatmoor Farm) presented in Table 11 and Table 12 are based on a long term measurement location (code 1) at Oak Tree Farm with no corrections applied for screening or distance (code A). Data has been applied from a distant measurement location where sound levels would be expected to be similar (code iii) and are considered representative of the prevailing sound climate, but variations in measured levels indicate that there may be a higher degree of uncertainty (code b).

12.4.7 The existing baseline sound levels presented for the Lower Greatmoor Farm assessment location presented in Table 11 and Table 12 are based on a long term measurement location (code 1) with no corrections applied for screening or distance (code A). Data has been applied from a measurement at or very close to the assessment location (code i) and are considered highly representative of the prevailing sound climate (code a).

Table 11: Existing baseline sound levels – Construction assessment

ID	Area Represented	Measurement location	Existing baseline sound level (dB)			Data source coding
			For construction sound assessment			
			Daytime LpAeq	Evening / Weekend LpAeq	Night-time LpAeq	
296808	Lower Greatmoor Farm	Lower Greatmoor Farm	60	59	48	1,A,i,a
297063	Finemerehill House	CS0080	47	44	40	1,A,iii,b

Table 12: Established baseline noise levels – Operational assessment

Assessment location	Daytime ambient noise level, LAeq,16hr (dB)	Night time ambient noise level, LAeq,8hr (dB)	Daytime background noise level, LA90 (dB)	Night time background noise level, LA90 (dB)
Lower Greatmoor Farm	59	48	44	44
Finemerehill House	46	39	39	28
Prune Farm Cottages	46	39	39	28
Oak Tree Farm	46	39	39	28

Future baseline

Construction

12.4.8 Without the Proposed Scheme, existing sound levels in this area are likely to increase due to the presence of the Greatmoor EfW facility operation and HS2 construction. Based on information in the Greatmoor EfW facility environmental permit, the worst case daytime LAeq,1hr noise level at Lower Greatmoor Farm is likely to be between 45 and 50dB due to the Greatmoor EfW facility operation. It has been assumed, on a reasonable worst case basis that no change in baseline sound levels will occur between the existing baseline (2016 – as presented in Table 11) and the future baseline during construction.

12.4.9 The assessment of noise from construction traffic assumes a baseline year of 2019, representative of the middle of the construction period when the construction traffic flows are expected to be at their peak.

Operation

12.4.10 The proposed EWR2 upgrade is expected to be operational by 2022 running along the existing rail corridor. The rail route will include one diesel passenger train per hour each way, running at 145kph. A noise model has been used to calculate changes in baseline noise levels in accordance with these assumptions.

12.4.11 The calculated rail noise levels for the EWR2 upgrade confirm that it will cause no material change to noise baseline levels at residential receptors in the study area.

12.5 Effects arising during construction

Avoidance and mitigation measures

12.5.1 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction.

12.5.2 The assessment of construction noise assumes the implementation of the principles and management processes set out in the draft CoCP that 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;
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise, including control of working hours; and
- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments.

Assessment of impacts and effects

Quantitative identification of impacts and effects

Ground-borne vibration

12.5.3 All construction activities which may lead to noticeable vibration level, such as compaction are located further than 85m from the nearest residential and non-residential communities. No non-residential receptors / land uses where low ambient vibration or sound is critical to operations have been identified in the vicinity of the Proposed Scheme.

12.5.4 No impacts have been predicted on residential and non-residential receptors as the result of construction ground-borne sound and vibration from construction activities.

Airborne sound: direct effects

12.5.5 The assessment results and impact criteria for the assessment of construction works at residential receptors are presented in Table 13. There is a single residential property at each of the assessment locations. Neither of which is forecast to be adversely impacted by the construction works. No non-residential properties are included in the assessment study area.

Table 13: Assessment of construction noise at residential receptors

Assessment location		Impact criteria				Significant effect
ID	Area represented	Typical/highest monthly outdoor L_{pAeq} [dB] at the facade [Assessment category A/B/C]			Construction activity resulting in highest forecast noise levels	
		Day 0700-1900	Evening 1900-2300	Night 2300-0700		
296808	Lower Greatmoor Farm	56/61 [A]	<40/41 [C]	<40/41 [C]	Bridleway GUN/28 accommodation green overbridge - Superstructure	
297063	Finemerehill House	48/53 [A]	<40/<40 [A]	<40/<40 [A]	Bridleway QUA/36 accommodation green overbridge - Superstructure	

12.5.6 The following additional notes give explanation of the information within Table 13:

Where the significant effect column is highlighted in pink, then a significant effect is identified at the referenced community, or individual non-residential receptor

* Significant effect – the quantitative impact methodology has identified either:

1) no impact at this receptor but further information (see assessment) has identified that a significant effect is nonetheless likely; or

2) an impact at this receptor which, based upon further qualitative receptor information, (see assessment text) does not gives rise to a significant effect.

~ Significant effect - impacted dwellings which are either spatially remote from larger defined residential areas, or a small number of dwellings whose impact is not considered to represent the larger defined residential area, and as such are not considered to be part of a community significant effect.

12.5.7 Refer to Map ES-25: Assessment and Monitoring Locations for Construction Sound, Noise & Vibration Assessments in Volume 3 Environmental Statement Maps for assessment locations used in the assessment.

Airborne sound: indirect effects

12.5.8 The results for the roads where potentially significant effects could arise are presented in Table 14.

Table 14: Assessment of construction traffic noise levels

Road name	Future baseline sound level (dB)	Future baseline sound level + construction traffic (dB)	Change (dB)	Significant effect
	Daytime $L_{pA10,16hr}$ 0700-23:00	Daytime $L_{pA10,16hr}$ 0700-2300		
Station Road (south west of Quainton Road)	60	63	4	

12.5.9 Explanation of the information within Table 14 is as follows:

Where the significant effect column is heighted in dark red, then a significant effect is identified on nearby communities or individual receptors.

Change values

Yellow denotes a minor impact – a change is of 3-5 dB or 1-3dB where a high existing sound level is identified

Orange denotes a moderate impact – a change is of 5-10 dB or 3-5dB where a high existing sound level is identified

Red denotes a major impact – a change is of >10 dB or >5dB where a high existing sound level is identified

Residential receptors: direct effects - individual dwellings

12.5.10 No residential buildings are forecast to experience noise levels higher than the significant observed adverse effect level (SOAEL[47]) from works associated with construction of the Proposed Scheme.

Residential receptors: direct effects - communities

12.5.11 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

12.5.12 No residential communities are forecast to experience direct adverse effects from noise from works associated with construction of the Proposed Scheme that would be considered significant on a community basis.

12.5.13 Significant construction vibration effects on residential receptors are unlikely to occur from works associated with construction of the Proposed Scheme.

Residential receptors: indirect effects

12.5.14 Significant noise effects on residential receptors arising from construction traffic associated with construction of the Proposed Scheme are unlikely to occur.

12.5.15 A change in noise level has been predicted to occur on Station Road (south west of Quainton Road) as a result of construction traffic from the Proposed Scheme during peak periods. Taking into account the number of receptors and the existing baseline sound levels from other sources in the area a significant effect has not been identified at residential properties close to this road.

[47] The SOAEL is the level above which significant adverse effects on health and quality of life occur.

Non-residential receptors

12.5.16 No non-residential properties are included in the assessment study area.

Cumulative effects from the Proposed Scheme and other committed development

12.5.17 This assessment has considered the potential cumulative construction noise effects of the Proposed Scheme and other committed developments.

12.5.18 It is assumed that the construction works for HS2 will coincide with those of the Proposed Scheme. Based on the predicted construction noise levels in the HS2 Phase One ES, this is unlikely to substantially increase the construction noise level the nearby receptors are exposed to from those presented in Table 13.

12.5.19 The assessment of indirect noise effects from construction traffic does not change if the construction of the Proposed Scheme coincides with the peak period construction traffic from HS2 based upon traffic data provided.

12.5.20 Construction of the Proposed Scheme may coincide with the construction of the EWR2 upgrade. Details of the construction works associated with the EWR2 upgrade are not available and an environmental statement is yet to be prepared, however, along with the Proposed Scheme, the EWR2 upgrade will need to apply 'Best Practicable Means' mitigation measures in accordance with the Control of Pollution Act 1974 in order to minimise noise and vibration from construction. Compliance with the 'Best Practicable Means' mitigation measures will reduce as far as possible the likelihood of cumulative effects occurring.

12.5.21 Construction noise or vibration from the Proposed Scheme is unlikely to result in any significant cumulative noise effects.

Other mitigation measures

12.5.22 No further mitigation measures are proposed other than those described above and in the draft CoCP.

Summary of likely significant residual effects

12.5.23 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it is does not reach a level where it would significantly affect residents.

12.5.24 The measures also reduce the adverse effects of outdoor construction noise on the acoustic character around the local residential communities such that the effects are not considered to be significant.

12.6 Effects arising during operation

Avoidance and mitigation measures

Fixed plant noise emissions

12.6.1 Limits for fixed plant noise emissions are set in accordance with the methodology set out in the HS2 Phase One ES, Volume 5, Appendix SV-001-000: Sound, noise and vibration: methodology, assumptions and assessment (route-wide), Annex E. This

annex describes a methodology for specifying limits for noise emitted by stationary systems, which thereby avoid any likely significant adverse effects.

12.6.2 Plant noise emissions limits, defined in Annex E, which in the form of plant noise rating levels (LAr,Tr) set in accordance with BS 4142:2014, are as follows:

- "The proposed control regime contains two distinct principles. Installations will be designed, constructed, installed and maintained so that:
  - the rating level minus the background level is not more than -5dB, as far as reasonably practicable; and
  - limiting the rating level not to exceed +5dB above the background level."

12.6.3 The background noise level is defined as the typical measured LA90 between 0700 and 2300 for the daytime, and the typical measured LA90 between 2300 and 0700 for the night time.

12.6.4 Potential forms of onsite mitigation for fixed plant are attenuators, enclosures and screening. Additional noise mitigation measures in the form of fence barriers may be required to mitigate noise impacts from the excavator and rail mounted gantry crane on Lower Greatmoor Farm residential receptor. The mitigation design will be determined at detailed design stage.

Onsite vehicular movements

12.6.5 Environmental mitigation barriers (noise and light), which are 4m above local ground level, are provided to the eastern and northern sides of the haulage route over the Bridleway GUN/28 accommodation green overbridge and on the western edge of the sidings.

12.6.6 These barriers are primarily to mitigate noise and light to the adjacent woodland habitat creation areas, but also provide some noise screening to Finemerehill House residential receptor to the north-east and to the residents to the west.

Assessment of impacts and effects

Fixed plant noise emissions

12.6.7 Noise from fixed mechanical and electrical plant equipment including the excavator and rail mounted gantry crane will be mitigated such that the limits described in paragraph 12.6.1 are met. Since fixed plant noise limits will be met in accordance with HS2 Phase One ES, Volume 5, Appendix SV-001-000: Sound, noise and vibration: methodology, assumptions and assessment (route-wide), Annex E, no adverse impacts or likely significant effects are anticipated.

Onsite vehicular movements

12.6.8 The calculated daytime and night-time operational ambient noise levels for noise from the onsite vehicle movements are given in Table 15.

12.6.9 Daytime and night time levels have been assessed on a reasonable worst case basis, based on the assumption that the sidings are operating at full capacity for all permitted operating hours during months where working hours are not restricted

(January, February, November and December). Red, orange and yellow shading indicate a major, moderate and minor impact respectively.

Table 15: Calculated Operational ambient noise levels

Assessment location	Number of residential properties represented	Baseline ambient noise level (dB)		Operational ambient noise (dB)		Change (dB)	
		Day, LAeq,16hr	Night, LAeq,8hr	Day, LAeq,16hr	Night, LAeq,8hr	Day	Night
Lower Greatmoor Farm	1	59	48	62	54	3	6
Finemerehill House	1	46	39	48	42	2	3
Prune Farm Cottages	2	46	39	49	44	3	5
Oak Tree Farm	1	46	39	46	39	0	0
Knowl hill Farm	1	46	39	47	40	1	2
Edgecott House	1	46	39	49	43	3	4

12.6.10 During the night time, operational noise impacts due to onsite vehicular movements are assessed as moderate adverse at Lower Greatmoor Farm, Prune Farm Cottage and Edgecott House and minor at Finemerehill House.

12.6.11 During the daytime, operational noise impacts due to onsite vehicular movements are assessed as minor adverse at Lower Greatmoor Farm.

12.6.12 Elsewhere, during the daytime, operational noise impacts due to onsite vehicular movements are below the Lowest Observable Adverse Effect Level (LOAEL)[48] of 50dBLAeq,16hr and are therefore assessed as negligible.

12.6.13 Taking into account the number and geographical extent of the adverse noise impacts, the effects arising are not considered significant when assessed on a community basis.

Effects on animals

12.6.14 The calculated noise levels in adjacent woodland areas from onsite vehicular movements and unloading processes are appreciably lower than the 100dB SEL threshold for impacts on birds and mammals. Therefore no impacts on birds or mammals in the surrounding habitats are identified.

Cumulative effects

12.6.15 The HS2 Phase One ES identified major adverse impacts due to operational noise at Lower Greatmoor Farm, Finemerehill House and Oak Tree Farm and a moderate

[48] The LOAEL is the level above which adverse effects on health and quality of life can be detected.

adverse impact at Prune Farm Cottages due to operational noise from the high speed railway.

12.6.16 A likely significant adverse effect was identified in the HS2 Phase One ES, at Lower Greatmoor Farm and as such this property has also been identified as a potential qualifying for noise insulation due to operational noise from the high speed railway.

12.6.17 When assessed in accordance with the methodology set out in the HS2 Phase One ES, Volume 5, Appendix SV-001-000: Sound, noise and vibration: methodology, assumptions and assessment (route-wide), Annex A, the cumulative noise impacts due to the operation of the Proposed Scheme and operation of HS2 Phase One would remain unchanged from the impacts identified in the HS2 Phase One ES, as described above.

Other mitigation measures

12.6.18 It is assumed that the mitigation proposed as part of the HS2 Phase One Phase One scheme in respect of Lower Greatmoor Farm, Finemerehill House, Oak Tree Farm and Prune Farm Cottages will be implemented and mitigate the identified cumulative effect.

12.6.19 No other mitigation measures are proposed.

Summary of likely significant residual effects

12.6.20 No likely significant residual effects have been identified during operation.

13 Traffic and transport

13.1 Introduction

13.1.1 This traffic and transport section describes the likely impacts on all forms of transport and the consequential effects on transport users arising from the construction of the Proposed Scheme.

13.1.2 With regards to traffic and transport, the main issue as a result of the Proposed Scheme is traffic generated during construction. The operational impacts of the Proposed Scheme are not expected to be significant, as the amount of traffic generated during operation will be very small (i.e. comprising ad-hoc maintenance vehicle trips) and is not anticipated to have an impact on the local road network and other road users. Operational traffic impacts have therefore not been included within the assessment.

13.1.3 The effects on traffic and transport have been assessed quantitatively, based on baseline conditions and future scenarios.

13.1.4 A detailed report on traffic and transport, and surveys undertaken, is contained in Volume 4.11: Environmental Statement Technical Appendix: Transport Assessment.

13.1.5 Engagement has been undertaken with BCC as the Highway Authority.

13.2 Assessment methodology

Scope, assumptions and limitations

13.2.1 The assessment scope, key assumptions and limitations for the traffic and transport assessment are set out in the HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

13.2.2 As the Proposed Scheme is linked to the HS2 Phase One scheme, assessment of impacts within this ES have been undertaken in two ways:

- with a baseline including the HS2 Phase One scheme. The assessment of the Proposed Scheme has been made against this baseline; and
- to demonstrate the cumulative impact of both the Proposed Scheme and the HS2 Phase One scheme, a combined assessment has been made against a baseline which does not include HS2 Phase One.

13.2.3 The study area covers the highway network anticipated to be utilised by construction vehicles generated by the Proposed Scheme. Within the immediate vicinity of the Proposed Scheme, this includes Station Road, Quainton and the A41 between Aylesbury and Bicester. The study area also includes land on which PRoW are situated, where they may be significantly impacted by the Proposed Scheme.

13.2.4 The baseline forecast traffic flows for the construction future year of assessment have been derived using the Department for Transport's traffic forecasting tool, Trip End Model Presentation Program (TEMPRO). The assessment covers the morning (08:00-09:00) and evening peak (17:00-18:00) periods for an average weekday.

13.2.5 Based upon the programme in Section 2.7, construction activity will conclude in 2019. This year forms the traffic and transport assessment year for construction, assuming the highest level of background growth over the construction period for robustness. Operational impacts with respect to traffic do not form part of the scope for the EIA. Therefore, this is not considered further in this section.

13.2.6 It has been assumed that bus services for the assessment year will be the same as those currently operating, since it is not possible to forecast how the services may change in the future.

13.2.7 Future year traffic flows with and without the Proposed Scheme are based on an approach that does not take account of wider effects, such as redistribution and reassignment of traffic, modal shift and peak spreading. As a consequence, adverse transport effects may be over-stated.

13.3 Legislation and planning policy framework

13.3.1 The key planning policy documents relevant to this section are:

- National Planning Policy Framework (2012);
- National Planning Practice Guidance;
- BCC Strategic Plan (2015-2017);
- BCC Local Transport Plan 4 (2016-2036);
- Buckinghamshire Freight Strategy; and
- Vale of Aylesbury Local Plan (Draft, 2016).

13.4 Environmental baseline

Existing baseline

13.4.1 Existing conditions within the study area have been determined through transport surveys commissioned as part of the HS2 Phase One ES, liaison with BCC to source accident data, and publically available information on public transport services.

13.4.2 The main construction access for the Proposed Scheme is proposed to be served from the HS2 Phase One scheme Station Road Overbridge Satellite compound (accessed via Station Road, from the A41). The two sites are linked via the HS2 trace so there will be no construction vehicles on the public highway between them. The roads primarily affected by construction traffic of the Proposed Scheme and subject to assessment are the A41 (between Aylesbury and Bicester) and Station Road (Quainton). Beyond the A41, construction trips will distribute onto routes towards the motorway network (primarily the M40).

13.4.3 Access along Greatmoor Road will be required during construction for new utility supplies for the Proposed Scheme and for access to the Greatmoor Railway Sidings Rail Systems satellite compound. It will also provide maintenance access for Network Rail purposes at the operational phase. Greatmoor Road is not proposed to be used for civil engineering works construction traffic

13.4.4 The traffic survey data utilised to establish current use of the road network subject to assessment originated from Automatic Traffic Counts (ATCs), undertaken in 2012 or 2015, at the following locations:

- A41 (east of Blackgrove Road);
- A41 Aylesbury Road (Blackthorn);
- A41 Boundary Lane (Bicester); and
- Station Road.

13.4.5 The traffic survey data utilised to establish the current operation of the A41/ Station Road junction subject to assessment originated from a Manual Classified Count (MCC) and queue length survey, undertaken in April 2015.

13.4.6 PRoW surveys to establish the nature of the PRoW and their usage by pedestrians, cyclists and equestrians (non-motorised users) were undertaken in August and September 2012 as part of the HS2 Phase One ES. The PRoWs potentially impacted by the Proposed Scheme are Public bridleway QUA/36/2 & QUA/36/3, Public footpath QUA/35/1,Public bridleway QUA/37/1, Public footpath GUN/31/1, Public footpath GUN/30/1, Public bridleway GUN/31/2, Public footpath GUN/31/1, Public footpath GUN/29/1, Public footpath CAG/2/1, Public bridleway GUN/25/2, Public bridleway GUN/28/1, QUA/37/1, WOD/1/4, Public bridleway GUN/25/1 and Public bridleway CAG/3/1.

13.4.7 Relevant accident data for the road network subject to assessment had been obtained from BCC for the most recent five year period up to the end of March 2016 (01/04/2011 - 31/03/2016). This has been assessed and any identified clusters have been examined. No accident clusters have been identified in the area.

13.4.8 The following three public bus services operate along roads that are subject to traffic and transport assessment:

- Route 16 and 17 – connecting Aylesbury to Steeple Claydon and Bicester; and
- Route 18 – connecting Buckingham to Aylesbury.

13.4.9 These services operate along the A41, with a combined peak frequency of up to three buses an hour. Bus Route 16 also operates along Quainton Road/Station Road with a weekday peak frequency of one bus an hour.

13.4.10 The Proposed Scheme will be located on agricultural land directly to the east of the Aylesbury Link railway line. The Aylesbury Link railway line, which extends beyond Aylesbury Parkway, provides freight-only services carrying waste from London to the waste facility at Calvert. Freight trains use the line at a frequency of approximately up to four a day, some of which also use the Bicester to Bletchley Line.

Future baseline

13.4.11 The future baseline traffic volumes have been calculated by applying growth factors derived from TEMPRO for the construction assessment year of 2019. The factors have been derived for the individual road types and relevant wards. The baseline traffic volumes also take specific account of the consented changes to the Greatmoor EfW

facility, including the provision of the new access road to the facility from the A41 Bicester Road.

13.4.12 The proposed EWR2 upgrade will provide a strategic railway connection between East Anglia and Central, Southern and Western England. It is currently expected to be in construction from 2019 and operational by 2022. EWR2 passenger services between Milton Keynes and Aylesbury are expected to operate on the upgraded Aylesbury Link railway line alongside the HS2 Phase One scheme, with a service frequency of one passenger train per hour in each direction. Future operations at the Calvert landfill site and potentially the Greatmoor EfW facility may result in an increase in freight trains using the Aylesbury Link freight only line. However, the Proposed Scheme does not impact upon the number of services and the capacity of the railway line will remain the same.

13.4.13 The Proposed Scheme does not impact upon navigable waterways.

Construction

13.4.14 Construction activities have been assessed against 2019 baseline traffic flows. Future baseline traffic volumes in the peak hours in this area (excluding the impact of the HS2 Phase One scheme) are forecast to grow by between around 6% and 12% (12 hour flows) by 2019, compared to 2012/ 2015.

13.5 Effects arising during construction

Avoidance and mitigation measures

13.5.1 The following measures have been included as part of the engineering design of the Proposed Scheme and will avoid or reduce impacts on transport users:

- all roads within the vicinity of the Proposed Scheme will be kept open during construction resulting in no diversions of traffic onto alternative routes;
- HGV routeing, as far as reasonably practicable, will be along the strategic road network and using designated routes;
- construction of embankments utilising locally sourced material which does not need to be transported via the public highway network;
- provision of temporary alternatives to maintain connectivity for PRoW closed during construction, as far as reasonably practicable, to reduce loss of amenity; and
- providing on-site welfare facilities to reduce travel by site workers.

13.5.2 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will include measures which seek to avoid or reduce environmental impacts during construction.

13.5.3 The assessment in this ES is also made on the basis that the Proposed Scheme will use a derivative of the HS2 Phase One scheme Framework Travel Plan, with the aim of reducing construction workforce commuting by private car, especially sole occupancy car travel.

Assessment of impacts and effects

Temporary effects

13.5.4 The following section considers the impacts on traffic and transport and the consequential effects resulting from construction of the Proposed Scheme.

13.5.5 As set out in Section 13.2: Assessment methodology, assessment of impacts has been undertaken in two ways, which allows impacts to be assessed for the Proposed Scheme alone and also cumulatively with the HS2 Phase One scheme.

13.5.6 The temporary traffic and transport impacts within the area will be:

- construction vehicle movements to/from the construction site compounds; and
- PRoW closures and diversions.

13.5.7 Powers are sought to stop up the Greatmoor Road temporarily in order to allow for the utility apparatus to be installed in the road but access to all properties served by the road will be maintained at all times and the impact will be negligible.

13.5.8 Construction vehicle movements required to construct the Proposed Scheme include the delivery of plant and materials, movement of sub base material and site worker trips. Construction of the Proposed Scheme is proposed to be served from the HS2 Phase One scheme Station Road overbridge satellite compound (accessed via Station Road, from the A41). From the compound, construction vehicles will utilise the proposed HS2 Phase One scheme internal access road to the Proposed Scheme site.

13.5.9 The duration of peak traffic activity at the construction site related to works for the Proposed Scheme is shown in Table 16. Also shown is the estimated number of daily vehicle trips during the peak period of activity.

Table 16: Peak vehicle trip generation for construction-site

Compound type	Location	Access to / from	Indicative start/set up date	Estimated duration of peak use	Average daily combined two-way[49] vehicle trips within peak period of activity	
					Cars/LGV	HGV
Satellite	Station Road overbridge	Station Road, from the A41	September 2019	2 months	140	120-150

13.5.10 Information on the indicative construction programme and methodology is provided in Section 2. Whilst it shows that the phasing of construction activities is staggered, there is some overlapping of activities. To enable a robust assessment, the cumulative total of construction trips generated for all activities has been calculated and used for the assessment.

[49] Two- way trips are comprised of both 'in' and 'out' journeys. For example, 140 two-way trips could comprise 70 inbound and 70 outbound vehicle movements or 140 inbound and zero outbound movements.

13.5.11 Construction of the Proposed Scheme is expected to result in changes in daily traffic flows due to works and construction vehicles accessing the worksite.

13.5.12 It is proposed that the A41 and Station Road will provide the primary HGV access route to the construction site, with vehicles then routed from Station Road to the construction site via the HS2 Phase One scheme trace. There would also be minor access from Greatmoor Road during rail systems work

Baseline including the HS2 Phase One scheme (assessment of the Proposed Scheme)

13.5.13 Construction of the Proposed Scheme alone will result in substantial increases in daily traffic flows (i.e. more than 30% increase in HGVs) and these will cause a significant adverse effect in relation to traffic related severance for non-motorised users in the following location:

- Station Road, between the A41 and the Station Road overbridge satellite compound, due to an increase in HGVs (moderate adverse significant effect).

13.5.14 The HS2 Phase One scheme, assumed in the baseline, results in the temporary stopping up of Bridleway QUA/36/2 & QUA/36/3, Public footpath QUA/35/1, Public footpath GUN/31/1, Public footpath CAG/2/1 and Bridleway GUN/28/1. The Proposed Scheme does not result in any significant change to this.

13.5.15 The changes in traffic flows related to the Proposed Scheme do not lead to a significant increase in delays to vehicle users and congestion at the A41/ Station Road junction.

13.5.16 There will be no significant effect on bus services or disruption at stations or interchanges resulting from construction of the Proposed Scheme alone.

13.5.17 No significant effects on parking or loading have been identified during construction in this area.

13.5.18 The effect on accident and safety risks will not be significant as there are no locations where there are both accident clusters and substantial increases in traffic during construction.

Combined assessment of the Proposed Scheme and the HS2 Phase One scheme (against baseline excluding the HS2 Phase One scheme ()

13.5.19 Construction of the Proposed Scheme and the HS2 Phase One scheme cumulatively will result in substantial increases in daily traffic flows (i.e. more than 30% increase in HGVs and/or all vehicles) and these will cause a significant adverse effect in relation to traffic related severance for non-motorised users in the following locations:

- Station Road, between the A41 and the Station Road overbridge satellite compound, due to an increase in both HGVs and all vehicles (moderate adverse significant effect); and
- A41, between A41/ Blackgrove Road and A41/ The Broadway, due to an increase in HGVs (moderate adverse significant effect);
- A41 Aylesbury Road, between A41/ The Broadway and A41/ A4421 Charbridge

Lane, due to an increase in HGVs (major adverse significant effect); and

- A41 Boundary Way, between the A41/ A4421 Charbridge Lane and the B4030 (Bicester), due to an increase in HGVs (moderate adverse significant effect).

13.5.20 Construction of the Proposed Scheme and the HS2 Phase One scheme (cumulatively) will result in adverse effects on non-motorised users due to temporary PRoW diversions increasing travel distances at the following locations:

- Bridleway QUA/36/2 & QUA/36/3: temporary stopping up of bridleway during construction works (minor adverse significant effect);
- Public footpath QUA/35/1: temporary stopping up of bridleway during construction works (minor adverse significant effect);
- Public footpath GUN/31/1: temporary stopping up of bridleway during construction works (minor adverse significant effect);
- Public footpath CAG/2/1: temporary stopping up of bridleway during construction works (moderate adverse significant effect); and
- Bridleway GUN/28/1: temporary stopping up of bridleway during construction works (minor adverse significant effect).

13.5.21 The changes in Proposed Scheme and HS2 Phase One scheme traffic flows combined do not lead to a significant increase in delays to vehicle users and congestion at the A41/ Station Road junction.

13.5.22 There will be no significant effect on bus services, or disruption at stations or interchanges that will result from construction of the Proposed Scheme in combination with the HS2 Phase One scheme.

13.5.23 No significant effects on parking or loading have been identified during construction in this area.

13.5.24 The effect on accident and safety risks will not be significant as there are no locations where there are both accident clusters and substantial increases in traffic during construction.

Permanent effects

13.5.25 The only permanent traffic and transport impacts within the area will be PRoW closures and diversions.

13.5.26 No substantial impacts are expected on traffic related severance for non-motorised users, delays to vehicle users and congestion at junctions, waterways and canals, rail services, public transport interchanges, parking and loading, public transport, taxis or air transport resulting from the operation of the Proposed Scheme within the study area. Therefore, these traffic and transport impacts are not discussed further.

Baseline including the HS2 Phase One scheme (assessment of the Proposed Scheme)

13.5.27 The HS2 Phase One scheme, assumed in the baseline, results in a permanent diversion or stopping up of Public footpath QUA/35/1, Public footpath GUN/31/1,

Bridleway GUN/25/1 and Bridleway CAG/3/1. The Proposed Scheme does not result in any significant change to this.

Combined assessment of the Proposed Scheme and the HS2 Phase One scheme (against baseline excluding the HS2 Phase One scheme ()

13.5.28 Operation of the Proposed Scheme and the HS2 Phase One scheme cumulatively will result in adverse effects on non-motorised users due to temporary PRoW diversions increasing travel distances at the following locations:

- Footpath QUA/35/1: permanent diversion of approximately 100m (minor adverse significant effect);
- Footpath GUN/31/1: permanent diversion of approximately 200m (minor adverse significant effect);
- Bridleway GUN/25/1: permanent stopping up of bridleway, with alternative route of an additional distance of 2.2km provided (moderate adverse significant effect); and
- Bridleway CAG/3/1: permanent stopping up of bridleway, with alternative route of an additional distance of 2.2km provided (moderate adverse significant effect).

13.5.29 These effects are unchanged by the Proposed Scheme in comparison to the effects of the HS2 Phase One scheme.

Cumulative effects

13.5.30 The assessment includes the cumulative effects of planned development during construction by taking this into account within the background traffic growth. Operational traffic generated by the consented changes to the Greatmoor EfW facility have been accounted for within the future baseline.

13.5.31 The cumulative effects of the HS2 Phase One scheme have been assessed within the 'Baseline excluding the HS2 Phase One scheme' sections of this section.

Other mitigation measures

13.5.32 No further traffic and transport mitigation measures during the construction of the Proposed Scheme are considered necessary, based on the outcome of this assessment.

Summary of likely significant residual effects

13.5.33 The Proposed Scheme (with the proposed Hs2 Phase One scheme accounted for within the baseline) will result in a temporary moderate adverse significant residual effect in traffic related severance due to increased HGV traffic for non-motorised users of Station Road (between the A41 and the Station Road overbridge satellite compound) only. There are no other temporary significant effects resulting from the Proposed Scheme alone.

13.5.34 The combined impact of the Proposed Scheme and the HS2 Phase One scheme will result in a temporary adverse significant residual effects in traffic related severance for non-motorised users of: Station Road, between the A41 and the Station Road

overbridge satellite compound (moderate adverse effect for HGVs and all vehicles); the A41, between A41/ Blackgrove Road and A41/ The Broadway (moderate adverse effect for HGVs); the A41 Aylesbury Road, between A41/ The Broadway and A41/ A4421 Charbridge Lane (major adverse effect for HGVs); and the A41, between A41/ A4421 Charbridge Lane and B4030 (moderate adverse effect for HGVs).

13.5.35 The combined impact of the Proposed Scheme and the HS2 Phase One scheme will also result in temporary minor adverse significant residual effects on users of Bridleway QUA/36/2 & QUA/36/3, Public footpath QUA/35/1, Public footpath GUN/31/1 and Bridleway GUN/28/1 and a temporary moderate adverse significant residual effect on users of Public footpath CAG/2/1. This is due to the temporary stopping up of these PRoW. However, these effects are not changed by the Proposed Scheme.

13.5.36 The Proposed Scheme (with the Hs2 Proposed Scheme accounted for within the baseline) will not result in any permanent significant residual effects.

13.5.37 The combined impact of the Proposed Scheme and the HS2 Phase One scheme will result in permanent minor adverse significant residual effects on users of Public footpath QUA/35/1 and Public footpath GUN/31/1 and moderate adverse significant residual effects on users of Bridleway GUN/25/1 and Bridleway CAG/3/1 due to permanent diversions or closures, resulting in additional travel distances for users of these PRoW.

14 Water resources and flood risk

14.1 Introduction

14.1.1 This section of the report sets out the likely effects of the Proposed Scheme on the water environment. This includes effects on water resources (both surface water features and groundwater) and flood risk. Mitigation measures are proposed, where appropriate, and residual effects assessed.

14.1.2 The section provides a description of the current baseline for water resources, including surface water, groundwater and the baseline conditions for flood risk. The baseline description is followed by an assessment of the likely impacts and significant effects on these baseline conditions as a result of the construction and operation of the Proposed Scheme.

14.1.3 The main environmental features of relevance to water resources and flood risk comprise:

- potential impacts on the risk of flooding from the Muxwell Brook, the Mega Ditch and the River Ray tributaries on and near the site of the Proposed Scheme, surface water and groundwater;
- three SSSIs: Finemere Wood SSSI, Sheephouse Wood SSSI, and Grendon and Doddershall Woods SSSI;
- Grendon Underwood Meadows LWS; and
- superficial deposits comprising Alluvium and Glacial Deposits which may contain groundwater.

14.1.4 Key environmental issues relating to water resources and flood risk comprise:

- potential impacts to the risk of surface water flooding;
- restriction of groundwater flow by sub-surface structures, affecting superficial deposits and, possibly, features in SSSIs or the LWS which are dependent on shallow groundwater; and
- potential impacts on groundwater and surface water quality as a result of construction activities associated with excavation, deposition of material and piling associated with bridge construction.

14.1.5 Detailed reports on water resources and flood risk are contained in Volume 4: Environmental Statement Technical Appendices. These include:

- Volume 4.12: Environmental Statement Technical Appendix: Water resources assessment; and
- Volume 4.13: Environmental Statement Technical Appendix: Flood Risk Assessment.

14.1.6 Maps ES-27: Surface Water Baseline, ES-28: Groundwater Baseline and ES-29: Water Framework Directive in Volume 3 of this ES show details of the environmental baseline and design features referred to in this report.

14.2 Assessment methodology

Scope, assumptions and limitations

14.2.1 The assessment scope, key assumptions and limitations for the water resources and flood risk assessment are as set out in the HS2 Phase One ES, Volume 5, the SMR, and the SMR Addendum. The SMR and SMR addendum can be found in Volume 4.01: Environmental Statement Technical Appendix: Additional information.

14.2.2 This report follows the standard assessment methodology.

14.2.3 The spatial scope of the assessment is based upon the identification of surface water features within 1km of the site boundary, except where there is clearly no hydraulic connectivity. All groundwater bodies are considered that are within 1km horizontally of the site, and where there is an aquifer within 10m of the lowest possible construction or dewatering depth.

14.2.4 Outside of these distances it is unlikely that impacts upon the water environment will be attributable to the Proposed Scheme. For the purposes of this assessment this spatial scope is defined as the study area.

14.2.5 Potential impacts to groundwater quality from existing land contamination are presented in Section 10, Land Quality.

14.2.6 There is no data available with regards to groundwater levels. No monitoring of groundwater levels has been undertaken as part of this assessment. However, there is not anticipated to be any significant groundwater within the bedrock geology underlying the Proposed Scheme. Any groundwater levels and flow directions within superficial deposits have been inferred from topography and potential connectivity to surface watercourses that pass through the superficial deposits.

14.2.7 There is no data available regarding existing groundwater quality, although the assessment for this Proposed Scheme considers potential changes in water quality rather than absolute water chemistry conditions.

14.2.8 The Proposed Scheme includes an office and welfare facilities adjacent to the sidings. In the absence of a foul sewer nearby it has been assumed that foul water will be treated on site and subsequently discharged either to surface or ground with consent from the relevant authorising body.

14.2.9 The limitations associated with flood risk within this study area are described in detail in Volume 4.13: Environmental Statement Technical Appendix: Flood Risk Assessment.

14.2.10 Surface water discharge from the site will drain to a receiving waterbody, in general accordance with the principles of the non-statutory technical standards for sustainable drainage[50].

[50] Department for Environment, Food & Rural Affairs, 2015, *Non-statutory technical standards for sustainable drainage systems*

Surveys/source of information

14.2.11 Information has been obtained mainly from secondary/published sources such as the EA, the Lead Local Flood Authority, BCC and the British Geological Survey. The majority of the data is in the public domain. Hydrogeological information was obtained from geological maps, and borehole logs where available.

14.2.12 Site visits were carried out in January 2013 and April 2016. These visits included inspection of the Muxwell Brook, existing national rail culverts, and the area surrounding the Proposed Scheme.

14.2.13 Water Framework Directive (WFD) classification data has been made available by the EA. For surface watercourses that do not have a WFD status class shown in the relevant River Basin Management Plan (RBMP), the status class has been taken as the status class for the first downstream water body for which a status class is reported. Where groundwater does not have a WFD status class shown in the relevant RBMP, the groundwater body is referred to as 'not assessed by the EA'.

Study area

14.2.14 The study area includes land required for construction of the Proposed Scheme and for 1km outside of this boundary (total area considered approximately 640 hectares).

14.3 Legislation and planning policy framework

14.3.1 The key legislation and planning policies relevant to the consideration of water resources and flood risk impacts are:

National

- EU WFD; EU Groundwater Directive 2006[51]; EU Floods Directive 2007[52] and associated UK Flood Risk Regulations 2009[53]; EU Habitats Directive;
- Flood and Water Management Act 2010[54]; Water Act 2014[55]; the Environmental Protection Act 1990; the Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009[56]; Land Drainage Act 1994[57];
- EA Groundwater Protection: Policy and Practice (GP3)[58]; and
- the NPPF (as amended) where it pertains to flood risk, the associated Planning Practice Guidance (PPG) for Flood Risk and Coastal change and ancillary documentation from Central Government and the EA including Flood risk

[51] Official Journal of the European Union, 2006, *Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration*, European Commission
[52] Official Journal of the European Union, 2007, *Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the assessment and management of flood risks*, European Commission
[53] HM Government, 2009, *The Flood Risk Regulations*, The Stationery Office
[54] HM Government, 2010, *Flood and Water Management Act 2010*, The Stationery Office
[55] HM Government, 2014, *The Water Act 2014 (Commencement No. 21) Order 2014*, The Stationery Office
[56] HM Government, 2009, *Water Resources Act 1991 (Amendment) (England and Wales) Regulations 2009*, The Stationery Office
[57] HM Government, 1994, *Land Drainage Act 1994*, The Stationery Office
[58] Environment Agency; Planning & research; Our library; Publications and reports; Water reports; Groundwater; Management and protection; GP3 (Groundwater Protection Policy and Practice); http://www.environment-agency.gov.uk/research/library/publications/40741.aspx

assessments: climate change allowances[59].

Local

- local planning policy relating to water, for local authorities along the route of the Proposed Scheme (saved local plan policies and adopted Local Development Framework policy);
- Aylesbury Vale District Local Plan saved policy GP66, 2004;
- the emerging policies within the draft Vale of Aylesbury Local Plan 2016; and
- evidence base documents including the Local Flood Risk Management Strategy, and the Aylesbury Vale Strategic Flood Risk Assessment.

14.3.2 The WFD is the most relevant directive in terms of assessing the likely impacts and effects on water resources and flood risk from the Proposed Scheme. As a result, tests against the provisions of the WFD legislation have been built into the assessment methodology.

14.3.3 The assessment has due regard to the NPPF and the NPPF Technical Guidance, and also to Environmental Permitting Regulations and amendments[60].

14.4 Environmental baseline

Existing baseline

Surface water resources

Surface water features

14.4.1 All water bodies within the study area fall entirely within the Oxon Ray catchment which itself is within the Thames River Basin District (RBD) as set out in the Thames RBMP[61].

14.4.2 Map-27: Surface Water Baseline in Volume 3 of this ES shows the current surface water baseline. All surface water features within the study area are assessed within Volume 4.12: Environmental Statement Technical Appendix: Water resources assessment.

14.4.3 Table 17 includes surface water features potentially affected by the Proposed Scheme.

[59] Environment Agency, 2016, *Flood risk assessments: climate change allowances*, https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances
[60] HM Government, 2012, *The Environmental Permitting (England and Wales) (Amendment) Regulations 2012*, The Stationery Office
[61] Environment Agency (2016) *Thames River Basin District River Basin Management Plan*

Table 17: Surface water features potentially affected by the Proposed Scheme

Water feature	Location description (Map ES-27))	Watercourse classification[62]	WFD water body and current overall status	WFD predicted outcome (by 2027 as in RBMP)	Receptor value[63]
River Ray	Located to the south of the Proposed Scheme CFA12-SWC09	Main river	Ray and tributaries, Northeast of Grendon Underwood GB106039030100 Moderate	Good Status	Very High
Partly culverted Tributary of River Ray (culverted down stream of Finemere Wood)	Crosses the Proposed Scheme north of Woodlands Farm. CFA12-SWC10	Ordinary watercourse	No status class in RBMP – assumed status (from Ray and tributaries (North East of Grendon Underwood) GB106039030100 Moderate	No status class in RBMP – assumed status (from Ray and tributaries (North East of Grendon Underwood) Good Status	High
Unnamed Lake south of Finemere Wood	Unnamed Lake adjacent to the Proposed Scheme, south of Finemere Wood	Not classified	No status class in RBMP – assumed status (from Ray and tributaries (North East of Grendon Underwood) GB106039030100 Moderate	No status class in RBMP – assumed status (from Ray and tributaries (North East of Grendon Underwood) Good Status	Moderate
Unnamed Drain (known as the Mega Ditch)	Crosses the route south of Sheephouse Wood . CFA12-SWC11	Ordinary watercourse	No status class in RBMP – assumed status (from Ray and tributaries (North East of Grendon Underwood) GB106039030100 Moderate	No status class in RBMP – assumed status (from Ray and tributaries (North East of Grendon Underwood) Good Status	Moderate
10 x Unnamed Ponds	10 small isolated field ponds between Finemere Wood and Sheephouse	Not classified	Not assessed by the EA	Not assessed by the EA	Low

[62] Water-feature classifications: Section 113 of the Water Resources Act 1991 defines a main river as a watercourse that is shown as such on a main river map. Section 72 of the Land Drainage Act 1991 defines an ordinary watercourse as 'a watercourse that is not part of a main river'. Section 221 of the Water Resources Act 1991 defines a watercourse as including ' all rivers and streams, ditches, drains, cuts, culverts, dikes, sluices, sewers (other than public sewers) and passages through which water flows'. Main rivers are larger rivers and streams designated by Defra on the main river map and are regulated by the Environment Agency.

[63] For examples of receptor value see Table 43 in the SMR addendum (Volume 4.01: Environmental Statement Technical Appendix: Additional information).

Water feature	Location description (Map ES-27))	Watercourse classification[62]	WFD water body and current overall status	WFD predicted outcome (by 2027 as in RBMP)	Receptor value[63]
	Wood, north of the existing rail line				
2 x Unnamed Ponds	Two small isolated field ponds in the Greatmoor area south of the Proposed Scheme (400m to 700m)	Not classified	Not assessed by the EA	Not assessed by the EA	Low
6 x Unnamed Ponds	Six small isolated field ponds between Greatmoor and Woodlands Farm	Not classified	Not assessed by the EA	Not assessed by the EA	Low
Muxwell Brook	Runs north of the north western boundary of the Proposed Scheme	Ordinary watercourse	No status class in RBMP – assumed status (from Ray and tributaries (North East of Grendon Underwood) GB106039030100 Moderate	No status class in RBMP – assumed status (from Ray and tributaries (North East of Grendon Underwood) Good Status	High
2x Unnamed Lakes	Two unnamed lakes immediately south of the Proposed Scheme, to the south west of Sheephouse Wood (part of Calvert clay pits)	Not classified	Not assessed by the EA	Not assessed by the EA	Low
2 x Unnamed field drains	Two isolated field drains 440m to 850m south of the Proposed Scheme and to the south of the clay pit lakes	Ordinary watercourse	Not assessed by the EA	Not assessed by the EA	Moderate

Abstractions and permitted discharges

14.4.4 According to EA records, there are no licensed surface water abstractions within 1km of this site. Records from BCC show no unlicensed abstractions within 1km of the Proposed Scheme. There is the potential for unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.

14.4.5 The EA reported no current consented surface water discharges within 1km of the Proposed Scheme as of 24th March 2015. However, since this date, FCC has been granted permits for surface water discharge from the Greatmoor EfW facility and from the Calvert landfill (with two discharge locations within 1km of Proposed Scheme). Therefore, these FCC consents have been considered in this assessment.

Groundwater resources

Geology and hydrogeology

14.4.6 The geological formations within the study area are described further in Volume 4.12: Environmental Statement Technical Appendix: Water resources assessment.

14.4.7 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 18.

Table 18: Summary of geology and hydrogeology in the study area

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value
Superficial deposits						
Alluvium	Along the valley of the Muxwell Brook and River Ray	Clay, silt, sand and gravel	Secondary A	Not assessed by EA	Not assessed by EA	Moderate
Glacial Deposits	Outcrops to the east and north of the Proposed Scheme	Mainly clay, silt and sand	Secondary Undifferentiated	Not assessed by EA	Not assessed by EA	Moderate
Diamicton (mid Pleistocene)	Outcrops to the east and north of the Proposed Scheme overlying the Glacial Deposits (mid Pleistocene)	Till	Secondary Undifferentiated	Not assessed by EA	Not assessed by EA	Moderate

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value
Glacial Deposits (mid Pleistocene)	Outcrops to the east and north of the Proposed Scheme overlying the Glacial Deposits	Sand and Gravel	Secondary A	Not assessed by EA	Not assessed by EA	Moderate
Bedrock						
West Walton Formation	Overlying the Oxford Clay Formation to the southeast of the Proposed Scheme site	Calcareous mudstone, silty mudstone and siltstone	Unproductive	Not assessed by EA	Not assessed by EA	Low
Oxford Clay Formation (consisting of Weymouth Member, Stewartby Member and Peterborough Member)	Outcrops across most of the Proposed Scheme site	Mudstones	Unproductive	Not assessed by EA	Not assessed by EA	Low

Abstractions and permitted discharges

14.4.8 There are no licensed groundwater abstractions within 1km of the Proposed Scheme. There are no SPZ for Public Water Supply (PWS) groundwater sources in the study area. BCC has no records of unlicensed groundwater abstractions within 1km of the Proposed Scheme. However, there is the potential for unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.

14.4.9 The EA reports that there are no consented discharges to ground/groundwater within 1km of the Proposed Scheme.

Water dependant habitats

14.4.10 In addition to the watercourses identified in Table 17, there are a number of potentially water dependent ecological sites within 1km of the Proposed Scheme. These are:

- Finemere Wood SSSI - a tributary of the River Ray passes through Finemere Wood;
- Grendon and Doddershall Woods SSSI - the River Ray and one of its tributaries run through Grendon Wood;
- Sheephouse Wood SSSI – a tributary of the Muxwell Brook passes through

Sheephouse Wood (and the brook is located along the south east boundary of the wood); and

- Grendon and Doddershall Meadows LWS.

14.4.11 Details of the ecological receptors at each of these sites are given in Section 8.1, Ecology.

Flood Risk

River flooding

14.4.12 According to the EA Flood Zone Map, the Proposed Scheme is located in Flood Zone 1, but adjacent to the flood zones of the Muxwell Brook (refer to Volume 4.13: Environmental Statement Technical Appendix: Flood Risk Assessment for further details). The Muxwell Brook is located along the south-eastern boundary of Sheephouse Wood, and flows in a south-westerly direction, passing beneath the existing Aylesbury Link railway line in a culvert approximately 40m to the north-west outside of the boundary of the Proposed Scheme.

14.4.13 The Muxwell Brook has a catchment size of approximately 4km^2 at the intersection with the Aylesbury Link railway line which bounds the site of the Proposed Scheme. The Muxwell Brook is conveyed beneath the existing Aylesbury Link railway line by two culverts. During a site visit to the area in January 2013, out-of-channel flow was observed along the base of the natural valley, discharging via the existing underbridge and adjacent culvert. Although the site visit was undertaken during the winter months, there had been no exceptional rainfall events in the preceding days, and it is unlikely that flows in the watercourse will have been significantly elevated above normal levels. It is possible that the existing infrastructure has insufficient capacity to convey the flow due to blockage. At the time of a subsequent site visit carried out in April 2016, the Muxwell Brook flow was in channel. There was no flow through the adjacent culvert and the underbridge although a non-perennial flow path was clearly evident along the natural valley located between the Proposed Scheme and Sheephouse Wood SSSI. A more detailed description of the hydrology of the Muxwell Brook is contained within Volume 4.13: Environmental Statement Technical Appendix: Flood Risk Assessment. Downstream of the Aylesbury Link railway line is the Calvert landfill. No properties are at risk of flooding from the Muxwell Brook within the study area, but the access road to Lower Greatmoor Farm is crossed by the flood zones and is therefore at risk of flooding.

Surface water flooding

14.4.14 The EA publishes an online Surface Water Flooding Map, the updated Flood Map for Surface Water (uFMfSW) which shows areas at risk of flooding, as well as predicted flood depths and velocities for three design events. The mapping can be used to define the risk of flooding from surface water.

14.4.15 The Proposed Scheme crosses areas shown on the uFMfSW to be at risk of surface water flooding, associated with (from south to north), a culverted tributary of the Muxwell Brook/River Ray near Finemere Wood, four natural dry valleys, and the Muxwell Brook.

Sewer flooding

14.4.16 There are no known sewers in the vicinity of the site, and consequently there is not currently any risk of flooding from this source.

Artificial water bodies

14.4.17 Reservoir failure and overtopping, failure or overtopping of navigable waterbodies, and failure of water mains constitute the primary means of flooding from artificial sources. There are no known upstream reservoirs or canals in the vicinity of the site, nor currently any known water supply infrastructure on, or in close proximity to, the site.

Groundwater flooding

14.4.18 The Aylesbury Vale Strategic Flood Risk Assessment implies there is generally a low risk of groundwater flooding in the district. This is confirmed in the Buckinghamshire Preliminary Flood Risk Assessment where it is reported that less than 25% of the study area is at risk of groundwater flooding.

14.4.19 As described in the groundwater baseline, the bedrock in the area is unproductive. There are superficial aquifers located in close proximity to the site of the Proposed Scheme, however these are limited to alluvial deposits, along the valleys of the Muxwell Brook and the tributary to the south of the development area, and glacial deposits, located to the north and east of the Proposed Scheme.

14.4.20 According to the BGS susceptibility to groundwater flooding dataset, there is a risk of groundwater emerging at the surface within these alluvial deposits. Groundwater levels in the alluvium are likely to be heavily influenced by water levels in the associated watercourses. All elements of the Proposed Scheme are located above the level of the watercourses.

Future baseline

14.4.21 The future baseline assumes construction of the proposed HS2 Phase One scheme, located on the southern side of the existing Aylesbury Link railway line, will be underway during construction and operation of the Proposed Scheme.

Climate change

14.4.22 Current projections to the 2080s indicate that climate change may affect the future baseline against which the impacts of the Proposed Scheme on surface water and groundwater resources have been assessed. There may be changes in the flow and water quality characteristics of surface water and groundwater bodies as a result of changes in climate. However, these changes are not considered to result in the reported effects from the Proposed Scheme changing in significance.

14.4.23 Current projections indicate that there will be more frequent, higher intensity rainfall events in the future. The probability and severity of river and surface water flooding could therefore increase due to frequent, higher intensity storms.

14.4.24 When considering the influence that climate change may have on the future baseline, against which impacts from the Proposed Scheme on flood risk have been evaluated, the assessment has used the recommended precautionary sensitivity ranges of rainfall

intensities, as given in the EA climate change allowance for planners issued 19th February 2016. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.

14.4.25 Further information on the potential additional impacts of climate change for water resources and flood risk is provided in Volume 4 Technical Appendices, 4.11 Water Resources Assessment and Volume 4 Technical Appendices, 4.12 Flood Risk Assessment.

14.5 Effects arising during construction

Avoidance and mitigation measures

14.5.1 The assessment in this ES is made on the basis that the Proposed Scheme will be constructed in compliance with the draft CoCP (refer to Volume 4.14: Environmental Statement Technical Appendix: Draft CoCP). This will avoid or reduce environmental impacts during construction.

14.5.2 The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme. These measures and standards of work will provide effective management and control of the impacts during the construction period.

14.5.3 The following examples illustrate how measures in the draft CoCP will reduce potentially adverse effects on water resources and flood risk arising during construction.

14.5.4 With regard to surface water, the draft CoCP stipulates that works in or near watercourses will be designed in consultation with the EA, so that sediment mobilisation is managed, the potential for contamination from fuel spills is reduced, and the works are timed to minimise the impact on water quality and water dependent habitats and species. These requirements will apply at the boundaries of the site near the Muxwell Brook.

14.5.5 Proactive management practices will ensure that, should a pollution incident occur, the impact is minimised, controlled and reported to relevant parties and remediated in accordance with the pollution incident control plan as set out in the draft CoCP.

14.5.6 The Greatmoor Railway Sidings Rail Systems satellite compound will be located within an area at risk of flooding from surface water. An individual flood risk assessment will be undertaken for the compound and mitigation incorporated into the site layout, to include bunds and drainage ditches designed to convey the 1 in 100 years return period (1% annual probability) rainfall event including an appropriate allowance for climate change around the compound without increasing the risk of flooding on the compound or surrounding land. Surface water runoff from the compound will be collected in drains surrounding the compounds and attenuated to below existing discharge rates.

14.5.7 Replacement floodplain storage will be provided for any significant losses arising due to structures, built volume or ground raising within the modelled 1 in 100 years return period floodplain, including an appropriate allowance for climate change. Replacement floodplain storage in all cases will be provided prior to construction in the floodplain. No works will be undertaken within the flood zones of the Muxwell

Brook. However, the Proposed Scheme falls within the area proposed for replacement flood storage for the proposed HS2 Phase One scheme. Consequently, the proposed HS2 Phase One mitigation will be modified to ensure sufficient mitigation is provided.

14.5.8 Rain falling on impermeable surfaces will be collected and discharged to nearby watercourses, having first been passed through appropriate sustainable drainage systems (SuDS) features to attenuate runoff rates to the equivalent Greenfield rate for each drainage catchment, for all events up to and including the 1 in 100 years return period rainfall event including an allowance for climate change. The total volume and peak rates of runoff discharging to the local watercourses during extreme rainfall events will be equal to or less than existing discharge rates.

14.5.9 Drainage attenuation and balancing ponds proposed as mitigation for the proposed HS2 Phase One scheme will be displaced by the Proposed Scheme. These ponds will be replaced to the same capacity and specification, prior to commencement of any works within the area of the HS2 Phase One scheme mitigation.

Assessment of impacts and effects

Temporary effects

Surface water

14.5.10 With implementation of the mitigation proposed, including application of the draft CoCP, no significant temporary effects on surface water have been identified.

Groundwater

14.5.11 The bedrock is classified as unproductive strata and therefore there is no pathway for impacts on groundwater. Groundwater is likely to be present in the superficial deposits but the assessment has shown that due to the mitigation proposed, including application of the draft CoCP, no significant temporary effects on groundwater have been identified.

Flood risk

14.5.12 With implementation of the mitigation proposed, including application of the draft CoCP, no significant temporary effects on flood risk have been identified.

Permanent effects

Surface water

14.5.13 With implementation of the mitigation proposed, including application of the draft CoCP, no significant permanent effects on surface water have been identified.

Groundwater

14.5.14 With implementation of the mitigation proposed, including application of the draft CoCP, no significant permanent effects on groundwater have been identified.

Flood risk

14.5.15 With implementation of the mitigation proposed, including application of the draft CoCP, no significant permanent effects on flood risk have been identified.

Cumulative effects

14.5.16 No cumulative effects on water resources or flood risk have been identified.

Other mitigation measures

14.5.17 No additional mitigation measures are required.

Summary of likely significant residual effects

14.5.18 There are no likely significant residual effects for water resources and flood risk.

14.6 Effects arising from operation

Avoidance and mitigation measures

14.6.1 Site specific examples of design measures that will mitigate impact include the drainage arrangements for the Proposed Scheme in the study area.

Assessment of impacts and effects

Temporary effects

14.6.2 There are considered to be no significant temporary adverse effects to surface water, groundwater or flood risk arising from operation of the Proposed Scheme.

Permanent effects

14.6.3 There are considered to be no significant permanent adverse effects to surface water, groundwater or flood risk arising from operation of the Proposed Scheme.

Cumulative effects

14.6.4 There are considered to be no significant cumulative adverse effects to surface water, groundwater or flood risk arising from operation of the Proposed Scheme.

Other mitigation measures

14.6.5 There are considered to be no further measures required to mitigate adverse effects on surface water resources or groundwater resources or flood risk.

Summary of likely significant residual effects

14.6.6 There are considered to be no significant residual effects to surface water, groundwater or flood risk arising from operation of the Proposed Scheme.

15 Summary of likely residual significant effects

15.1 Introduction

15.1.1 The following significant residual effects have been identified during construction and operation of the Proposed Scheme.

15.2 Agriculture, forestry and soils

Construction

15.2.1 No BMV agricultural land will be affected by the Proposed Scheme.

15.2.2 The Proposed Scheme will not give rise to any significant residual effects on agricultural or soil resources. However, as the Proposed Scheme is part of the wider development of HS2 Phase One, it should be noted that two holdings (Portway Farm and Doddershall Estate) are already significantly affected by the construction of the HS2 Phase One scheme. The Proposed Scheme compounds that effect on Portway Farm.

15.2.3 Finemere Wood nature reserve and Oak Tree Farm are not significantly affected.

Operation

15.2.4 Insofar as the Proposed Scheme is simply a relocation of an existing facility that operates close to agricultural land it is not considered that there will be any significant impacts on agriculture or soil arising from the operation of the Proposed Scheme.

15.3 Air quality

Construction

15.3.1 There are no likely significant residual effects during construction of the Proposed Scheme.

Operation

15.3.2 There are potentially significant impacts on Sheephouse Wood SSSI, which could lead to a significant effect on this habitat.

15.3.3 The existing waste haulage vehicles truck vehicle fleet will either be renewed for lower emission vehicles or will cease to operate through the application of controls via a planning condition. This will remove the potentially significant effect on Sheephouse Wood SSSI.

15.4 Community

Construction

15.4.1 There will be no significant residual effects during construction.

Operation

15.4.2 There will be no significant residual effects during operation.

15.5 Cultural heritage

Construction

15.5.1 The Proposed Scheme will result in the permanent adverse significant effect through the loss of any potential archaeological remains that may be present within the Proposed Scheme area. In addition, there will be a permanent (moderate) residual effect in the setting and appreciation of Finemerehill House, from the changes to the surrounding agricultural landscape and the introduction of new rail infrastructure into the key views from the asset.

Operation

15.5.2 There will be no significant residual effects during operation.

15.6 Ecology

Construction

15.6.1 The construction of the Proposed Scheme in combination with the construction of the HS2 Phase One scheme and the EWR2 upgrade will lead to disturbance of the nearby pair of breeding barn owls. This will result in a significant adverse residual effect on a cumulative basis on the conservation status of this species that is significant at the county level.

15.6.2 The mitigation measures described reduce the effects on all other receptors to a level that is not significant.

Operation

15.6.3 No significant residual effects on ecological receptors are likely to occur as a consequence for operation of the Proposed Scheme.

15.7 Land quality

Construction

15.7.1 No likely significant adverse effects are anticipated with the application of the mitigation measures detailed in the draft CoCP, those defined in the Environmental Permit (held by the landfill and Greatmoor EfW operator) and those instigated as part of required remediation strategies.

Operation

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

15.8 Landscape and Visual assessment

Construction

15.8.1 There will be moderate adverse significant effects during construction on landscape character in the following LCAs:

- Kingswood Wooded Farmland LCA;

- Finemere Hill LCA; and
- Claydon Bowl LCA.

15.8.2 There will be moderate adverse significant effects during construction on:

- Viewpoint 146.2.001: View west from Finemerehill House;
- Viewpoint 146.3.002: View south-west along Footpath GUN28/1 and from the Claydon Woods Circular Walk (Bridleway GUN/33/1 and GUN/33/2) between Sheephouse Wood and Greatsea Wood; and
- Viewpoint 148.2.001: View south-west from Knowlhill Farm.

Operation

15.8.3 There will be no significant effects on landscape character in the LCAs during operation.

15.8.4 There will be significant effects on the following viewpoints during operation:

- Viewpoint 146.2.001: View west from Finemerehill House. Significant effects are likely during year 1 of operation. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse non-significant effect by year 15 of operation;
- Viewpoint 146.3.002: View south-west along Footpath GUN28/1 and from the Claydon Woods Circular Walk (Bridleway GUN/33/1 and GUN/33/2) between Sheephouse Wood and Greatsea Wood. Significant effects are likely during year 1 of operation. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse non-significant effect by year 15 of operation; and
- Viewpoint 146.3.005: View north-west and south-east from the bridge over the Aylesbury Link railway line (Footpath GUN 28). Significant effects are likely during year 1 of operation. The low magnitude of change assessed alongside the high sensitivity of the receptor will result in a minor adverse non-significant effect by year 15 of operation.

15.9 Sound , noise and vibration

Construction

15.9.1 The avoidance and mitigation measures reduce noise inside all dwellings from the construction activities such that it is does not reach a level where it would significantly affect residents.

15.9.2 The measures also reduce the adverse effects of outdoor construction noise on the acoustic character around the local residential communities such that the effects are not considered to be significant.

Operation

15.9.3 No likely significant residual effects have been identified during operation.

15.10 Traffic and transport

15.10.1 The Proposed Scheme (with the proposed Hs2 Phase One scheme accounted for within the baseline) will result in a temporary moderate adverse significant residual effect in traffic related severance due to increased HGV traffic for non-motorised users of Station Road (between the A41 and the Station Road overbridge satellite compound) only.

15.10.2 The combined impact of the Proposed Scheme and the HS2 Phase One scheme will result in a temporary adverse significant residual effects in traffic related severance for non-motorised users of: Station Road, between the A41 and the Station Road overbridge satellite compound (moderate adverse effect for HGVs and all vehicles); the A41, between A41/ Blackgrove Road and A41/ The Broadway (moderate adverse effect for HGVs); the A41 Aylesbury Road, between A41/ The Broadway and A41/ A4421 Charbridge Lane (major adverse effect for HGVs); and the A41, between A41/ A4421 Charbridge Lane and B4030 (moderate adverse effect for HGVs).

15.10.3 The combined impact of the Proposed Scheme and the HS2 Phase One scheme will result also result in temporary minor adverse significant residual effects on users of Bridleway QUA/36/2 & QUA/36/3, Public footpath QUA/35/1, Public footpath GUN/31/1 and Bridleway GUN/28/1 and a temporary moderate adverse significant residual effect on users of Public footpath CAG/2/1. This is due to the temporary stopping up of these PRoW. However, these effects are not changed by the Proposed Scheme.

15.10.4 The Proposed Scheme (with the Hs2 Proposed Scheme accounted for within the baseline) will not result in any permanent significant residual effects.

15.10.5 The combined impact of the Proposed Scheme and the HS2 Phase One scheme will result in permanent minor adverse significant residual effects on users of Public footpath QUA/35/1 and Public footpath GUN/31/1 and moderate adverse significant residual effects on users of Bridleway GUN/25/1 and Bridleway CAG/3/1 due to permanent diversions or closures, resulting in additional travel distances for users of these PRoW.

15.11 Water resources and flood risk

Construction

15.11.1 There are no likely significant residual effects for water resources and flood risk.

Operation

15.11.2 There are considered to be no significant residual effects to surface water, groundwater or flood risk arising from operation of the Proposed Scheme.