LONDON-WEST MIDLANDS ENVIRONMENTAL STATEMENT

Volume 2 | Community Forum Area report

CFA11 | Stoke Mandeville and Aylesbury

November 2013

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Department for Transport

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

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Structure of the HS2 Phase One Environmental Statement

The Environmental Statement (ES) documentation comprises:

- Non-technical summary (NTS) – which provides a summary in non-technical language of the Proposed Scheme, the likely significant environmental effects of the Proposed Scheme, both beneficial and adverse, and the means to avoid or reduce the adverse effects;
- Volume 1: Introduction to the Environmental Statement and the Proposed Scheme – which provides an introduction to HS2, an overview of the hybrid Bill process and the Environmental Impact Assessment (EIA) methodology, an introduction to consultation and engagement, and the main strategic and route-wide alternatives considered;
- Volume 2: Community forum area reports and map books – 26 reports and associated map books providing a description of the scheme and of environmental effects in each area;
- Volume 3: Route-wide effects – provides an assessment of the effects of the Proposed Scheme where it is not practicable to describe them within the community forum area descriptions in Volume 2;
- Volume 4: Off-route effects – provides an assessment of the off-route effects of the Proposed Scheme;
- Volume 5: Appendices and map books – contains supporting environmental information and associated map books; and
- Glossary of terms and list of abbreviations – contains terms and abbreviations, including units of measurement, used throughout the ES documentation.

1 Introduction

1.1 Introduction to HS2

1.1.1 High Speed Two (HS2) is a new high speed railway proposed by the Government to connect major cities in Britain. Stations in London, Birmingham, Leeds, Manchester, South Yorkshire and the East Midlands will be served by high speed trains running at speeds of up to 360kph (225mph).

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

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

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

1.1.5 Section 4 of Volume 1 describes the anticipated operational characteristics of HS2, including the anticipated frequency of train services. As Volume 1 shows, the frequency of trains is expected to increase over time and to increase further upon opening of Phase Two. In assessing the environmental effects of the Proposed Scheme the anticipated Phase 2 operational frequency has been used. For further detail of the anticipated operation of the Proposed Scheme in the Stoke Mandeville and Aylesbury area (CFA11), see Section 2.4.

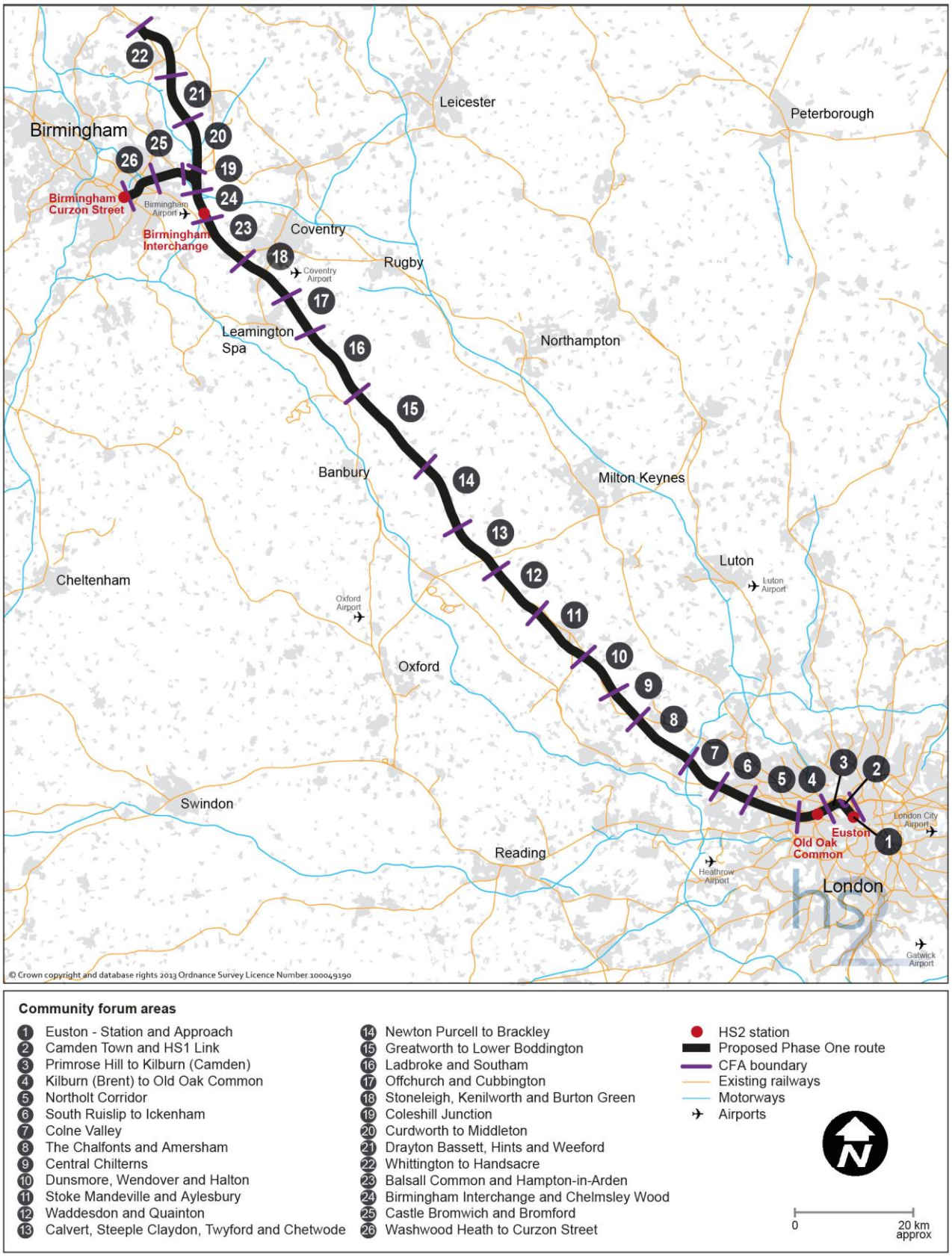
1.1.6 The Government believes that the HS2 network should link to Heathrow and its preferred option is for this to be built as part of Phase Two. However, the Government has since taken the decision to pause work on the Heathrow link until after 2015 when it expects the Airports Commission to publish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

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

1.2 Purpose of this report

1.2.1 This CFA report presents the likely significant effects of the construction and operation of the Proposed Scheme on the environment within CFA11 (Stoke Mandeville to Aylesbury). The report describes the mitigation measures that are proposed for the purpose of avoiding, reducing or managing the likely significant adverse effects of the Proposed Scheme on the environment within CFA11.

Figure 1: HS2 Phase One route and community forum areas



1.3 Structure of this report

1.3.1 This report is divided into the following sections:

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

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

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

1.3.4 Where appropriate, potential climate change impacts and adaptation measures are discussed in the relevant environmental topic section. Volume 1 and Section 6A of the SMR Addendum (Volume 5: Appendix CT-001-000/2) also include additional information about climate change adaptation and resilience.

1.3.5 The maps relevant to Stoke Mandeville and Aylesbury are provided in a separate corresponding document entitled Volume 2: CFA11 Map Book that should be read in conjunction with this report.

1.3.6 The Proposed Scheme described in this report is that shown on the Map Series CT-05 (construction) (Volume 2, CFA11 Map Book) and CT-06 (operation) (Volume 2, CFA11 Map Book). There is some flexibility during detailed design to alter the horizontal and vertical alignments and other details within the limits shown on the plans and sections submitted to Parliament and as set out in the hybrid Bill, and this flexibility is included within the scope of the environmental assessment. Further explanation is provided in Volume 1, Section 1.4.

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

2 Overview of the area and description of the Proposed Scheme

2.1 Overview of the area

2.1.1 The Stoke Mandeville and Aylesbury area (CFA11) covers an approximate 10.5km section of the Proposed Scheme in the districts of Aylesbury Vale and Wycombe, in the county of Buckinghamshire. The area extends from approximately 700m east of the A4010 Risborough Road, south of Stoke Mandeville, to approximately 200m south of the A41 Bicester Road near Cranwell Farm. It includes land within the parishes of Stoke Mandeville, Stone with Bishopstone and Hartwell, Quarrendon, Fleet Marston and Waddesdon.

2.1.2 As shown in Figure 2, Dunsmore, Wendover and Halton (CFA10) is located to the south and Waddesdon and Quainton (CFA12) is located to the north.

Settlement, land use and topography

2.1.3 The Stoke Mandeville and Aylesbury area is a predominantly rural landscape of mixed agricultural use, comprising mainly large scale arable fields with some historic small-scale irregular paddocks and pastures bordering settlements and occupying lower lying land. The area is typified by scattered farmsteads and villages. The topography is characterised by a series of gently undulating clay vales.

2.1.4 The route will pass approximately 270m from the southern tip of Stoke Mandeville and then approximately 200m from the southern edge of Aylesbury. The route will pass within approximately 1.1km of Bishopstone, 1km of Stone, and within 800m and 330m of Upper and Lower Hartwell, respectively. These villages lie to the south of the Proposed Scheme.

2.1.5 The Thame Valley and the River Thame are prominent features of the area. The Proposed Scheme will cross the River Thame approximately 550m south-east of Putlowes, to the west of Aylesbury. Woodland cover is low overall with the exception of the well-wooded Chiltern Hills chalk escarpment, which is a prominent feature in views to the south.

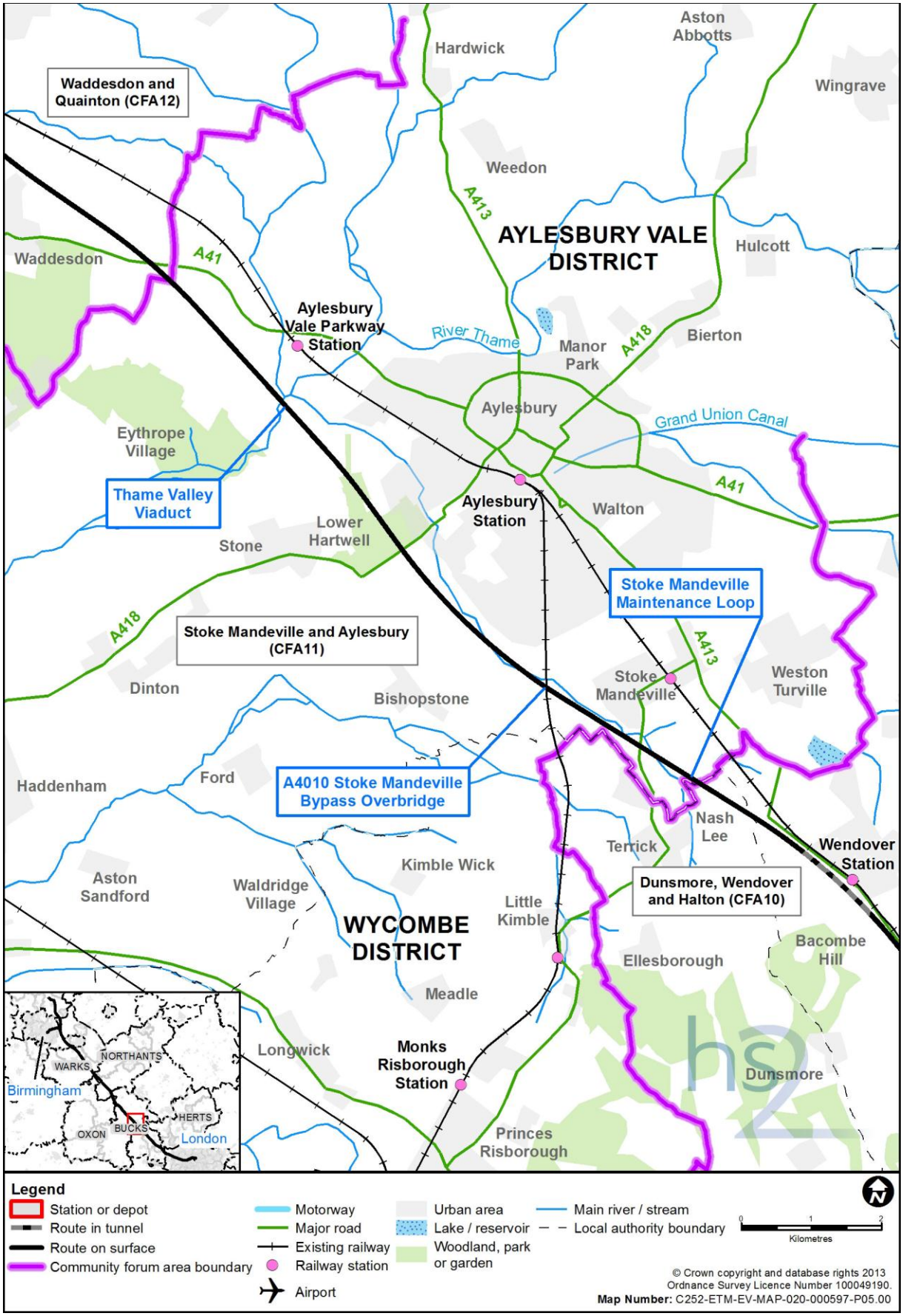
Key transport infrastructure

2.1.6 Principal highways in the area include the A4010 Risborough Road/Station Road in the south, which passes through Stoke Mandeville. The A418 Oxford Road connects a number of villages to the west of the Proposed Scheme to Aylesbury, while the A413 Wendover Road runs approximately parallel to the Proposed Scheme to Aylesbury, connecting with the A41 Bicester Road from Aylesbury to Waddesdon.

2.1.7 Other notable infrastructure in the area includes the Chiltern Railway Line, comprising the Marylebone to Aylesbury Line and the Princes Risborough to Aylesbury Line. The Princes Risborough to Aylesbury Line runs in a north-south direction and will cross over the Proposed Scheme.

2.1.8 The route will cross local access roads, bridleways and public footpaths, which provide important links between the scattered dwellings, surrounding villages, Aylesbury and Stoke Mandeville. These include the Thame Valley Walk, which will be crossed by the route to the west of Aylesbury. Several other public rights of way (PRoW) traverse the area close to the Proposed Scheme, including the North Buckinghamshire Way, Round Aylesbury Walk and Midshires Way.

Figure 2 Area context map



Socio-economic profile

2.1.9 To provide a socio-economic context for the area, data for the following demographic character areas (DCA) is used: Stoke Mandeville; Marsh and Bishopstone; West Aylesbury; Hartwell and Stone; and North West Aylesbury[1]. In total, the population of the DCA is approximately 26,100. The area's labour market outperforms England's as a whole; unemployment at 5.6% is lower than the national level of 7.4%, while 79.7% of the population aged 16-74 is economically active compared to the national figure of 69.9%[2]. There are approximately 10,600 people who work within the area[3].

Notable community facilities

2.1.10 The main shops and services are located in Aylesbury, which is the largest town near to the route in this area. There are some neighbourhood shops in Stoke Mandeville and the smaller villages of Sedrup, Stone and Hartwell. The villages of Hartwell and Sedrup have no community facilities of note (although the former has a riding school).

2.1.11 The area west of Aylesbury town centre is characterised by housing estates and an industrial estate. There are several community facilities to the west of Aylesbury including shops, public houses, children's nurseries, schools, playing fields, doctors' surgeries, dentists, churches, community halls and Stoke Mandeville Hospital. Other key community infrastructure includes: Booker Park School on Kynaston Avenue; Aylesbury Park Golf Club; Fairford Leys sports pitches and pavilion, which are adjacent to the golf club; the Round Aylesbury Walk; Aylesbury Ring Walk and the Thame Valley Walk.

2.1.12 Aylesbury has an extensive range of community facilities and is a main retail and service centre for communities along this stretch of the route. These facilities include a shopping centre, several post offices and a diverse range of local shops. There are civic offices, several community centres, nurseries and primary schools and five secondary schools; the Mandeville School specialist sports college will be the closest to the route within Aylesbury.

2.1.13 There are five doctors' surgeries (general practitioners) and dentists in the area. Hospitals within Aylesbury include the Stoke Mandeville Hospital, the closest to the route, and the Royal Buckinghamshire Hospital. There are 15 places of worship in Aylesbury, along with several community centres, including the Walton Court Community Centre.

[1] A DCA represents a community that, depending on the area, may consist of a local ward, neighbourhood or village(s).
[2] ONS (2011), *Population Census.* ONS, London.
[3] ONS (2012), *Business register and Employment Survey.* ONS, London.

2.1.14 There are several community facilities within Stoke Mandeville including shops, a railway station, post office, the Wool Pack public house on the A4010 Risborough Road, the Bull Inn public house on A4010 Risborough Road, the Bell on the B4443 Lower Road, St Mary the Virgin Church (Church of England (C of E)) and its associated burial ground, Stoke Mandeville Methodist Church, Stoke Mandeville Combined School, a community centre on Eskdale Road, playing fields and allotments. South of Stoke Mandeville is the burial site of the former Church of St Mary's, near to Mill House Farm off the A4010 Risborough Road. The Bucks Goat Centre (a children's animal farm with playground area and cafe) is also located on Old Risborough Road to the south of Stoke Mandeville.

2.1.15 Stoke Mandeville has a limited range of facilities; there is a post office and a few convenience shops. There is a primary school – Stoke Mandeville Combined School (catering for over 200 students in the four to eleven age group), Stoke Mandeville Methodist Church and the Stoke Mandeville Community Centre.

2.1.16 Sedrup, Stone and Hartwell are villages located on the A418 Oxford Road to the south-west of Aylesbury. The key community facilities within the villages include shops, post office, Bugle Horn public house, Bartlett's Residential Care Home, playing fields and Hartwell Riding Stables on the A418 Oxford Road. Facilities at Stone are also limited, and include a local store, a village hall, two churches (Stone Methodist Church and Church of St John the Baptist of Stone), the Rose and Crown Public House and two restaurants.

Recreation, leisure and open space

2.1.17 There are a number of recreational facilities in Aylesbury including a number of playgrounds, the Buckinghamshire Sports and Social Club, Edinburgh Sports Ground and Fairford Leys Football Pitches and playing fields. Aylesbury Park Golf Club is the largest recreational facility in the study area, with an 18-hole main course and a 9-hole short course set in historic parkland. There is a large allotment site within the study area located in Stoke Mandeville, close to Stoke Mandeville Combined School. A riding stables is located near to the route in Stone, along with Hartwell House Spa and Gym, a large spa located within the Grade I Hartwell House and associated Hartwell Grade II* Registered Park and Garden (RPG). Other local recreation and leisure facilities within the study area include the Bucks Goat Centre.

2.1.18 There are also a number of PRoW that cross the Thame Valley and link villages, the longest being the Thame Valley Walk, which is 24km long.

Policy and planning context

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

2.1.20 Buckinghamshire County Council adopted its Minerals and Waste Core Strategy in November 2012. This document is the overarching policy document for minerals and waste planning in the Stoke Mandeville and Aylesbury area.

2.1.21 Stoke Mandeville and Aylesbury falls within the jurisdiction of Aylesbury Vale and Wycombe District Councils. The following local policies have been considered and referred to where appropriate to the assessment:

- Aylesbury Vale District Council Vale of Aylesbury Action Plan Strategy 2011-2031 (2013)[4];
- Aylesbury Vale District Council Local Plan Saved Policies (2007)[5];
- Buckinghamshire County Council Structure Plan[6];
- Buckinghamshire County Council Minerals and Waste Core Strategy DPD (MWCS) (2012)[7];
- Wycombe District Council Adopted Core Strategy Development Plan Document (DPD) (2008)[8]; and
- Wycombe District Council Delivery and Site Allocations Plan For Town Centres and Managing Development (2013)[9].

2.1.22 There are a number of key planning designations in the area, which include scheduled monuments, Grade I and II listed buildings and parts of three conservation areas (Sedrup, Upper Hartwell and Hartwell). These are shown on Map Series CT-10 (Volume 2, CFA11 Map Book).

2.1.23 Emerging policies are not generally considered within this report, unless a document has been submitted to the Secretary of State for approval. It is worth noting that although the Vale of Aylesbury Plan Strategy Document has been submitted to the Secretary of State until it is adopted, the Aylesbury Vale District Council Local Plan Saved Policies (2007) still has weight.

Committed and proposed development

2.1.24 'Committed developments' have been taken into account for the purpose of assessing the likely significant environmental effects of the Proposed Scheme. Where these developments have a particular relevance to an assessment topic, this is noted in the future baseline section for that topic. The following developments are relevant to several topics assessments in this area.

[4] Aylesbury Vale District Council (2013), *Vale of Aylesbury Plan Strategy 2011-2031, Submission.*
[5] Aylesbury Vale District Council (2007), *Aylesbury Vale District Local Plan Written Statement 2004* Saved Policies.
[6] Buckinghamshire County Council (1991), *Buckinghamshire Structure Plan 1991-2011: Saved Policies.*
[7] Buckinghamshire County Council (2012), *Minerals and Waste Core Strategy Development Plan Document.*
[8] Wycombe District Council (2008), *Adopted Core Strategy Development Plan Document.*
[9] Wycombe District Council (2013), *Delivery and Site Allocations Plan for Town Centres and Managing Development.*

2.1.25 Aylesbury Vale District Local Plan allocation AY.13 (Berryfields Major Development Area (MDA)) and associated planning applications 07/03447/AOP, 03/02386/AOP, CC/29/11, 13/01962/ADP, 03/02386/AOP, 13/01577/ADP and 13/01748/ADP. The phasing for the development mentioned is described in the development brief as three stage development over a 10 year period. Development was started in 2010 and the sites are within 1km to 2km of the route centre line; details of the main planning applications are provided below.

2.1.26 Outline planning permission 07/03447/AOP is for a mixed development comprising housing (up to 235 dwellings), employment, and a full range of community facilities.

2.1.27 Outline planning permission 03/02386/AOP is for 3,000 dwellings (of which approximately 700 housing units have been assumed to be completed by 2017 with a further 2300 to be completed from 2017 to 2023), employment (Classes B1, B2 and B8), district centre (comprising a mix of Classes A1, A2, A3, A4 and A5, B1, C3, D1 and D2), two combined schools, a secondary school, public open space and recreation facilities, park and ride and accesses.

2.1.28 Planning permission CC/29/11 is for the provision of a new primary school and nursery within the Berryfields MDA. The 2-storey building consists of 420-place primary school, 52-place nursery, children's centre and community accommodation.

2.1.29 As construction of the above developments occur in part, after 2017, i.e. at the same time as the Proposed Scheme, they are considered to be a receptor for the operation of HS2, but also potentially to give rise to cumulative construction impacts with the Proposed Scheme on its neighbours. They are referred to in those topic sections where such a cumulative impact has been identified.

2.1.30 Planning applications yet to be determined and sites that are proposed allocations in development plans that have yet to be adopted, on or close to the Proposed Scheme, are termed 'proposed developments'. These are shown on CT-13-021b to CT-13-025a (Volume 2, Cross Topic Appendix 1 Map Book) and listed in Volume 5: Appendix CT-004-000. They are not included in the assessment. The progress of these proposals is being monitored by HS2 Ltd.

2.2 Description of the Proposed Scheme

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

2.2.2 The Proposed Scheme will require some land on a permanent basis, key features of which are illustrated in Maps CT-06-040b to CT-06-047a (Volume 2, CFA11 Map Book). Land that will also be required, but only on a temporary basis for construction, is set out in Section 2.3.

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

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

- the A4010 Stoke Mandeville bypass has been introduced, resulting in the removal of the A4010 Risborough Road and Marsh Lane overbridges, and the addition of the A4010 Stoke Mandeville bypass overbridge;
- additional land has been included to deliver environmental mitigation including landscape integration with recreational and wildlife opportunities;
- noise fence barriers have been increased in height to reduce potential noise effects;
- mitigation earthworks and planting have been revised to provide visual screening for noise fence barriers;
- the realignment of A418 Oxford Road has been revised;
- Thame Valley viaduct pier footing has been moved to avoid encroachment into the River Thame; and
- drainage pond locations and sizes have been rationalised along the route.

Overview

2.2.5 The Proposed Scheme through this area will be approximately 10.5km in length. The route will commence just north of Nash Lee and continue north-west across the A4010 Risborough Road, Marsh Lane and under the Princes Risborough to Aylesbury Line. The route will pass to the west of Stoke Mandeville and Aylesbury, passing under the A418 Oxford Road, and will then proceed to the east of Hartwell House. It will cross the River Thame to the north-east of Aylesbury, heading north-west across the Aylesbury Vale to exit the area south of the A41 Bicester Road. In this area the Proposed Scheme includes an extended realignment of the A4010 Risborough Road, running to the south and west of Stoke Mandeville with a single crossing over the railway and forming a bypass to Stoke Mandeville.

2.2.6 In this area Buckinghamshire County Council and the National Trust along with other organisations and local groups support initiatives for green infrastructure between the route of HS2 and the edge of Aylesbury. HS2 Ltd is committed to working with these groups and the wider community and has included within the Proposed Scheme land to enable additional landscape integration, recreational open space and potential ecological benefits to be provided.

Stoke Mandeville south embankment and Aylesbury south cutting

2.2.7 The Proposed Scheme will leave the Dunsmore, Wendover and Halton area (CFA10) on the Stoke Mandeville south embankment which continues for approximately another 1.4km in this area and is up to 5m high. The route will then descend into the Aylesbury south cutting which is approximately 2km long and up to 7m deep. This section of the Proposed Scheme extends from just north of B4009 Nash Lee Road to north of the Princes Risborough to Aylesbury Line on the south-western edge of Aylesbury. Key permanent features of this section, which is approximately 3.7km long, will include (see Maps CT-06-040b to CT-06-042; Volume 2, CFA11 Map Book):

- a maintenance loop (approximately 1.2km long) will extend from the Dunsmore, Wendover and Halton area. An access track will be provided along either side of the maintenance loop with access/egress from Nash Lee Lane on the east side and B4009 Nash Lee Road on the west side of the Proposed Scheme;
- Nash Lee Lane auxiliary substation will be located to the south of the existing A4010 Risborough Road at the north end of the maintenance loop. The substation will provide support to the maintenance loop lighting and a source of power when maintenance works are planned in that area;
- a replacement floodplain storage area to the east of the Proposed Scheme and to the south of Footpath ELL/20, which will be excavated to approximately 1m below existing ground level and re-graded[10];
- an area of ecological mitigation to the east of the Proposed Scheme, east of Footpath ELL/20 to provide wetland habitat creation to recreate wet grassland/fen habitat and potential grass snake translocation area;
- areas of landscape mitigation planting on the east and west side of the Proposed Scheme, to the north of Footpath ELL/20 overbridge to integrate the structure into the landscape;
- an area of ecological mitigation to the west of the Proposed Scheme north of Footpath ELL/20 to provide wetland habitat creation to recreate wet grassland/fen habitat and potential grass snake translocation area;
- a replacement floodplain storage area to the west of the Proposed Scheme, west of Stoke Brook, which will be excavated to approximately 1m below existing ground level and re-graded;
- a strip of hedgerow planting along an existing field boundary perpendicular to the route, to the east of the Proposed Scheme to screen views of the Proposed Scheme from the Grade II listed Stoke House;

[10] All replacement floodplain storage areas will be re-graded to tie back into existing ground level and returned to agriculture, wherever the farming practices are compatible with the land use.

- a noise fence barrier 3m high[11] and approximately 400m long on the west side and 200m long on the east of the Proposed Scheme from the south of Stoke House to just south of the A4010 Risborough Road;
- hedgerow planting parallel to the Proposed Scheme on both sides, from just south of Stoke House to south of Old Risborough Road, to visually screen the railway and the noise fence barriers from nearby residential properties;
- an area of scattered landscape planting to the west of the Proposed Scheme south of Mill House Farm which will also provide for the creation of wetland and grassland habitats and for the translocation of headstones and buried remains from the former site of St Mary's Church;
- a balancing pond for railway drainage south of the A4010 Risborough Road to the east of the Proposed Scheme with associated access from the A4010 Risborough Road;
- an underbridge just west of the A4010 Risborough Road, the finished ground level will be approximately 1m below existing ground level, providing a realignment for non-motorised user access to Stoke Mandeville;
- Old Risborough Road will be stopped up at its mid-point. Access to properties on Old Risborough Road will be maintained on either side of the Proposed Scheme;
- a balancing pond for railway drainage, north of Old Risborough Road to the east of the Proposed Scheme with an associated access track from Old Risborough Road;
- a noise fence barrier 4m high and approximately 900m long will be provided on the east side of the Proposed Scheme from just south of Old Risborough Road to just north of Marsh Lane;
- landscape earthworks on the east side of the Proposed Scheme, north of Old Risborough Road for approximately 1km to the Princes Risborough to Aylesbury rail overbridge. They will provide visual screening of the Proposed Scheme and noise fence barriers for residential properties in Stoke Mandeville and serve to integrate the Proposed Scheme into the landscape;
- a replacement floodplain storage area to the east of the Proposed Scheme just south of Footpath SMA/9, which will be excavated to approximately 1m below existing ground level and re-graded;
- an overbridge west of Stoke Mandeville approximately 9m above existing ground level, providing a realignment of farm access, Footpath

[11] Barrier heights are measured from the top of the rail.

SMA/8 and Footpath SMA/9. The approaches to the overbridge will be planted on the west side to integrate the structure into the landscape;

- Marsh Lane will be permanently stopped-up on either side of the Proposed Scheme but access to local properties, including Brook Farm and Moat Farm will be maintained;
- hedgerow planting along both sides of the Proposed Scheme from north of Old Risborough Road as far as the Princes Risborough to Aylesbury Line to provide visual screening of the Proposed Scheme from the western edge of Stoke Mandeville, and individual farm holdings such as Moat Farm and Brook Farm, and to integrate the route into the landscape;
- noise fence barriers 3m high and approximately 800m long will be provided on the east side of the Proposed Scheme from just north of Marsh Lane to the Princes Risborough to Aylesbury rail overbridge;
- an overbridge west of Stoke Mandeville, which will be approximately 6m above existing ground level, providing a new overbridge for the new A4010 Stoke Mandeville bypass and a realignment of Footpath SMA/11. The approaches to the overbridge will be planted to integrate the structure into the landscape;
- a new highway scheme, the A4010 Stoke Mandeville bypass approximately 2.9km long, will be provided leaving A4010 Risborough Road to the west of the Proposed Scheme, continuing west of the Proposed Scheme and parallel to it in a northerly direction, crossing the Proposed Scheme over the aforementioned overbridge and linking to the B4443 Lower Road to the east of the Proposed Scheme;
- hedgerow planting will be provided parallel to the new proposed A4010 Stoke Mandeville bypass to provide landscape integration;
- a balancing pond for highway drainage and associated access track from the A4010 Stoke Mandeville bypass, south of the Princes Risborough to Aylesbury Line to the west of the Proposed Scheme;
- two balancing ponds, associated with Stoke Mandeville bypass and associated access tracks will be located south of the Princes Risborough to Aylesbury Line to the east of the Proposed Scheme;
- an area of ecological mitigation will be provided to the east of the Proposed Scheme between the A4010 Stoke Mandeville bypass and the Princes Risborough to Aylesbury Line to provide habitat creation for reptile and amphibian species including great crested newts;
- a replacement floodplain storage area, east of the Proposed Scheme and the A4010 Stoke Mandeville bypass overbridge, which will be excavated to approximately 1m below existing ground level and re-graded;

- an overbridge west of Stoke Mandeville, approximately 4m above the existing ground level;
- realignment of a section of the Princes Risborough to Aylesbury Line approximately 15m to the north;
- a noise fence barrier 5m high and approximately 1.1km long on the east side of the Proposed Scheme from the Princes Risborough to Aylesbury rail overbridge to the end of the Aylesbury south cutting;
- a strip of landscape planting to the east of the Proposed Scheme, north of the Princes Risborough to Aylesbury Line to the end of the cutting, to screen views of the noise fence barriers from residential receptors in Aylesbury and users of the PRoW network;
- landscape earthworks on the east side of the Proposed Scheme, between Footpath SMA/16 accommodation overbridge and the end of the cutting to provide visual screening of the noise fence barriers along this section of route and to integrate the Proposed Scheme into the landscape;
- an overbridge approximately 5m above existing ground level, providing a realignment of farm access and Footpath SMA/16;
- a balancing pond and associated pumping station north of the Princes Risborough to Aylesbury Line to the east of the Proposed Scheme, with access from the overbridge north of the Princes Risborough to Aylesbury Line as previously described; and
- an area of ecological mitigation to the east of the Proposed Scheme between Footpath SMA/16 accommodation overbridge and Bridleway SBH/1 overbridge to provide habitat creation for reptile and amphibian species, including great crested newts.

Princes Risborough to Aylesbury rail overbridge

2.2.8 The Princes Risborough to Aylesbury Line runs broadly east-west, crossing the Proposed Scheme to the south-west of Aylesbury. It will be realigned approximately 15m to the north of its current alignment, with an overall length of realignment of approximately 1.82km. The realignment will commence just north of the Marsh Lane level crossing. It will cross over the Proposed Scheme on an overbridge approximately 4m above existing ground level, and rejoin the current alignment on the outskirts of Aylesbury. Key permanent features of this section will include the following (see Maps CT-06-041 to CT-06-42; Volume 2, CFA11 Map book):

- an overbridge west of Stoke Mandeville to carry the Princes Risborough to Aylesbury Line over the Proposed Scheme approximately 4m above existing ground level;
- an extension to an existing culvert, carrying an unnamed watercourse

under the Princes Risborough to Aylesbury Line;

- a balancing pond for railway drainage just south of the Marsh Lane level crossing, to the west of the Proposed Scheme. Access will be provided via Marsh Lane;
- a level crossing of the Princes Risborough to Aylesbury Line to the west of the Proposed Scheme providing a replacement of farm access and Footpath SMA/11; and
- a level crossing of the Princes Risborough to Aylesbury Line to the east of the Proposed Scheme proving an offline replacement of farm access and Footpath SMA/16.

Aylesbury south embankment and Oxford Road embankment

2.2.9 The Proposed Scheme will continue to the Aylesbury south embankment and Aylesbury north cutting section, which comprises an embankment approximately 1.3km long and up to 6m high, a cutting, approximately 750m long and up to 5m deep, and the Oxford Road embankment approximately 900m long and up to 4m high. This section extends from Bridleway SBH/19 to Aylesbury Park Golf Club to the west of Aylesbury. Key permanent features of this section, which is approximately 2.95km long, will include (see Maps CT-06-042 to CT-06-044, Volume 2, CFA11 Map Book):

- noise fence barriers approximately 2.9km long on the east side of the Proposed Scheme from the start of the embankment to the end of the section. The noise fence barriers will be up to 5m high as far as the existing Oxford Road. North of A418 Oxford Road the barriers will reduce to 4m in height, before returning to 5m for a 100m stretch at the end of this section;
- landscape earthworks on both sides of the Proposed Scheme from the start of the embankment to just south of the A418 Oxford Road, to screen the adjacent noise fence barriers from residents in Aylesbury and integrate the Proposed Scheme into the landscape;
- an overbridge west of Aylesbury, approximately 10m above existing ground level, providing a realignment of Bridleway SBH/19. The approaches to the overbridge will be planted to assimilate the structure into the landscape;
- areas of landscape mitigation planting provided to the east and west of the Proposed Scheme north of Bridleway SBH/19 to integrate the Proposed Scheme into the landscape and screen views from residents on the western fringes of Aylesbury;
- a land drainage area will be provided south of Footpath SBH/27 to the west of the Proposed Scheme;
- an overbridge west of Aylesbury, approximately 13m above existing

ground level, providing a realignment of Footpath SBH/27. The approaches to the overbridge will be planted to integrate the structure into the landscape;

- two balancing ponds for railway drainage north of Footpath SBH/27 and to the west of the Proposed Scheme, with access from the A418 Oxford Road;
- two land drainage areas, north of Footpath SBH/27 and to the west of the Proposed Scheme, with access from the A418 Oxford Road;
- an area of reed bed, to control contaminated leachate from the nearby landfill area, to the west of the Proposed Scheme north of Footpath SBH/27;
- noise fence barriers approximately 1.8km long on the west side of the Proposed Scheme from 300m to the south of Footpath SBH/34 to the end of this section. The barriers will be 3m high as far as the existing A418 Oxford Road. Between A418 Oxford Road and Footpath SBH/32 overbridge, the barriers will increase to 4m in height, before returning to 3m for the remaining length of this section;
- a balancing pond for highway drainage south of Footpath SBH/34 to the east of the Proposed Scheme with access from A418 Oxford Road;
- an overbridge west of Aylesbury, approximately 7m above existing ground level, providing a reinstatement of Footpath SBH/34. The approaches to the overbridge will be planted to integrate the structure into the landscape;
- strips of hedgerow planting on both sides of the Proposed Scheme to the south of the A418 Oxford Road to integrate the Proposed Scheme, the overbridge and access track into the landscape;
- a cap for the nearby landfill area to trap potential contaminants leaching out, to the west of the Proposed Scheme and to the south of the A418 Oxford Road;
- Sedrup express feeder auto-transformer[12] station and associated access track located approximately 200m south of A418 Oxford Road on the east side of the Proposed Scheme, with access from the A418 Oxford Road;
- a retaining wall, 150m in length, will be provided on the east of the proposed route, to allow the Sedrup express feeder auto-transformer station to be situated at track level;

[12] HS2 trains will draw power from overhead line equipment, requiring feeder stations and connections to the 400kV National Grid network. In addition to feeder stations, smaller auto-transformer stations will be required at more frequent intervals. There will be no feeder stations within the local area, but one auto-transformer station will be required.

- a balancing pond for highway drainage south of A418 Oxford Road to the west of the Proposed Scheme, with access from A418 Oxford Road;
- an overbridge west of Aylesbury, approximately 4m above existing ground level, providing a realignment of the A418 Oxford Road;
- areas of landscape planting will be provided to the north and south of the A418 Oxford Road, east and west of the Proposed Scheme to integrate the realigned A418 Oxford Road into the landscape and to enhance existing habitat links across the route for bats and other wildlife;
- a balancing pond for railway drainage north of A418 Oxford Road to the east of the Proposed Scheme, with access from A418 Oxford Road;
- an area of landscape planting to the north of A418 Oxford Road, east and west of the Proposed Scheme to strengthen existing woodland within the Grade II* Hartwell House RPG and screen views from Hartwell House;
- an overbridge west of Aylesbury Park Golf Club, approximately 12m above existing ground level, providing a reinstatement of Footpath SBH/32. The approaches to the overbridge will be planted to integrate the structure into the landscape;
- an area of landscape planting to the east of the Proposed Scheme along the western fringes of Aylesbury to provide visual screening for residents in Aylesbury;
- a replacement floodplain storage area to the east of the Proposed Scheme to the north of Footpath SBH/32, which will be excavated to approximately 1m below existing ground level and re-graded;
- two replacement floodplain storage areas to the west of the Proposed Scheme to the north of Footpath SBH/32, which will be excavated to approximately 1m below existing ground level and re-graded;
- a land drainage area north of Footpath SBH/32 to the west of the Proposed Scheme;
- an area of landscape planting will be provided to the north of Hartwell House, west of the Proposed Scheme to strengthen existing vegetation and screen views of the route from Hartwell House and the noise fence barriers along this stretch of route;
- a balancing pond for railway drainage and associated access track north of Footpath SBH/32, to the east of the Proposed Scheme; and
- provision of land within the Proposed Scheme to enable additional landscape integration, recreational open space and potential ecological benefits to be provided in the form of potential green infrastructure between the Proposed Scheme and Aylesbury.

Thame Valley viaduct and adjacent earthworks

2.2.10 The Proposed Scheme will continue onto the Thame Valley viaduct and adjacent earthworks section, which extends from the Aylesbury Park Golf Club, west of Aylesbury, to north of the River Thame. It comprises a cutting approximately 1km long and up to 6m deep, a 100m long embankment up to 5m high, a viaduct approximately 1km long and up to 6m high, another embankment approximately 0.1km long and up to 2m high and a further cutting approximately 800m long and up to 4m deep. Key permanent features of this section, which is approximately 3km long, will include (see Maps CT-06-044 to CT-06-046; Volume 2, CFA11 Map Book):

- landscape earthworks on the west side of the Proposed Scheme and to the west of Aylesbury, with planting on top of the earthworks to recreate the historic tree-lined avenue from Hartwell House, enhancing this feature in the listed landscape;
- noise fence barriers will extend along the east side of the Proposed Scheme for approximately 1km, from the start of the section to the start of the viaduct. The noise fence barriers will be 5m high, except for the last 150m where the noise fence barriers will reduce to a height of 3m;
- an overbridge north of Aylesbury Park Golf Club, approximately 5m above existing ground level, providing a realignment of Bridleway SBH/2. The approaches to the overbridge will be planted to integrate the structure into the landscape;
- an area of landscape planting to the north of Aylesbury Park Golf Club, east of the Proposed Scheme to integrate Bridleway SBH/2 overbridge into the landscape;
- an area of ecological mitigation to the south-west of the Aylesbury Sewage Works, to the east of the Proposed Scheme to provide habitat creation, including wetland and fen habitat suitable for amphibian and reptile species;
- a balancing pond north of Bridleway SBH/2 to the west of the Proposed Scheme, with access from Lower Hartwell;
- a replacement floodplain storage area to the west of the Proposed Scheme, which will be excavated to approximately 1m below existing ground level and re-graded;
- a viaduct to carry the Proposed Scheme over the River Thame that will be up to 6m above ground level. The viaduct will have 1.4m high protection barriers adjacent to the tracks on each side. The protection barrier will be modified along the east side to also act as an absorptive noise fence barrier;
- a balancing pond for railway drainage south of Putlowes to the west of

the Proposed Scheme, with access from Putlowes;

- a replacement floodplain storage area to the east of the Proposed Scheme, which will be excavated to approximately 1m below existing ground level and re-graded;
- an overbridge west of Putlowes, approximately 7m above existing ground level, providing a realigned farm access;
- a land drainage area west of Putlowes and to the west of the Proposed Scheme;
- areas of landscape planting to the north-west of Putlowes, east of the Proposed Scheme to provide visual screening and to integrate the route into the landscape;
- landscape earthworks on both sides of the Proposed Scheme from Putlowes to the end of the section, to integrate the route into the landscape and screen the noise fence barriers along the east of the Proposed Scheme; and
- hedgerow planting along the top of the landscape earthworks to tie in with the existing field boundaries and to provide visual screening.

Bicester Road embankment

2.2.11 The Proposed Scheme will continue onto the Bicester Road embankment, which is 1.2km long and up to 3m high. The embankment extends from north of the River Thame to just south of the A41 Bicester Road to the east of Waddesdon. Key permanent features of this section will include (see Maps CT-06-046 to CT-06-047a; Volume 2, CFA11 Map Book):

- an area of ecological mitigation to the north of Putlowes, west of the Proposed Scheme to provide habitat creation, including pond and grassland creation, for species including great crested newts and reptiles;
- landscape earthworks on both sides of the Proposed Scheme along the length of the embankment to integrate the structure into the landscape;
- hedgerow planting along the top of the landscape earthworks to tie in with the existing field boundaries and to provide visual screening;
- a land drainage area west of Fleet Marston, to the west of the Proposed Scheme;
- a replacement floodplain storage area to the west of the Proposed Scheme, which will be excavated to approximately 1m below existing ground level and re-graded;
- an overbridge west of Fleet Marston, which will be approximately 11m above existing ground level, providing a realignment of farm access and Bridleway FMA/1 and Footpath FMA/2. The approaches to the

overbridge will be planted to integrate the structure into the landscape;

- a land drainage area to the south of Footpath FMA/2, to the west of the Proposed Scheme;
- two areas of ecological mitigation to the south of the A41 Bicester Road, east of the Proposed Scheme, to provide habitat creation, including pond and grassland creation, for species including great crested newts and reptiles; and
- an area of landscape planting will be provided to the south of the A41 Bicester Road, east of the Proposed Scheme to integrate the route into the landscape.

2.3 Construction of the Proposed Scheme

2.3.1 This section sets out the strategy for construction of the Proposed Scheme in the Stoke Mandeville and Aylesbury area, including:

- overview of the construction process;
- description of the advance works;
- description of the engineering works to build the railway;
- construction waste and material resources;
- commissioning the railway; and
- indicative construction programme (see Figure 5).

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

2.3.3 In addition to the land that will be required permanently by the Proposed Scheme (see Section 2.2), land will be required on a temporary basis for construction. Key temporary construction features are illustrated on the construction maps series CT-05 (Volume 2, CFA11 Map Book). Following construction works, land required temporarily will be prepared for its eventual end use, which will include being returned to its pre-construction use wherever appropriate.

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

Overview of the construction process

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

- advance works, including: site investigations further to those already

undertaken; preliminary mitigation works; preliminary enabling works;

- civil engineering works, including: establishment of construction compounds; site preparation and enabling works; main earthworks and structure works; site restoration; and removal of construction compounds;
- railway installation works, including: establishment of construction compounds; infrastructure installation; connections to utilities; changes to the existing rail network; and, removal of construction compounds; and
- system testing and commissioning.

2.3.6 General provisions relating to the construction process are set out in more detail in Volume 1, Section 6.3 and the draft CoCP (see Volume 5: Appendix CT-003-000/1) including:

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

Advance works

2.3.7 General information about advance works can be found in Volume 1, Section 6.4. Advance works will be required before commencing construction works and will typically include:

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

Engineering works

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

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

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

2.3.9 The construction of the Proposed Scheme will be subdivided into sections, each of which will be managed from construction compounds. The compounds will act as the main interface between the construction worksites and the public highway, as well as performing other functions as described below. Construction compounds will either be main compounds or satellite compounds, which are generally smaller. Some compounds will be used for civil engineering works and others for railway installation works, and in some cases for both.

2.3.10 In the Stoke Mandeville and Aylesbury area there will be one main compound and four civil engineering satellite compounds and five railway installation satellite compounds (of which three will continue to use compounds previously established for the civil engineering works).

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

General overview of construction compounds

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

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

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

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

- railheads will connect the existing railway network to enable loading and unloading to and from trains delivering material to the HS2 site or removing excavated material;
- roadheads will require an additional area of land adjacent to the compound for the storage and loading and unloading of bulk earthworks materials which are moved to and from the site on public highways; and
- living accommodation for the construction workforce.

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

2.3.16 Further information on the function of compounds, including general provisions for their operation, including security fencing, lighting, utilities supply, site drainage, codes of worker behaviour are set out in Volume 1, Section 6.6, and the draft CoCP, Section 5.

Construction traffic routes

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

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

Figure 3: Schematic of construction compounds for civil engineering works

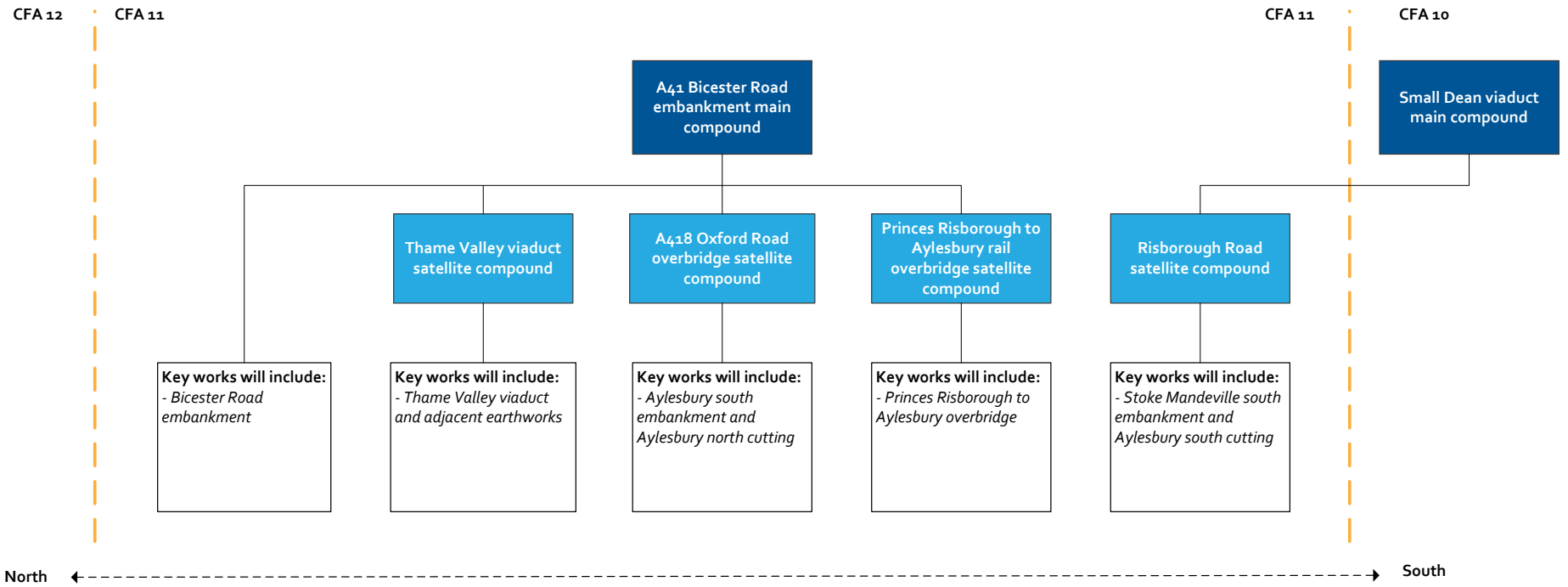
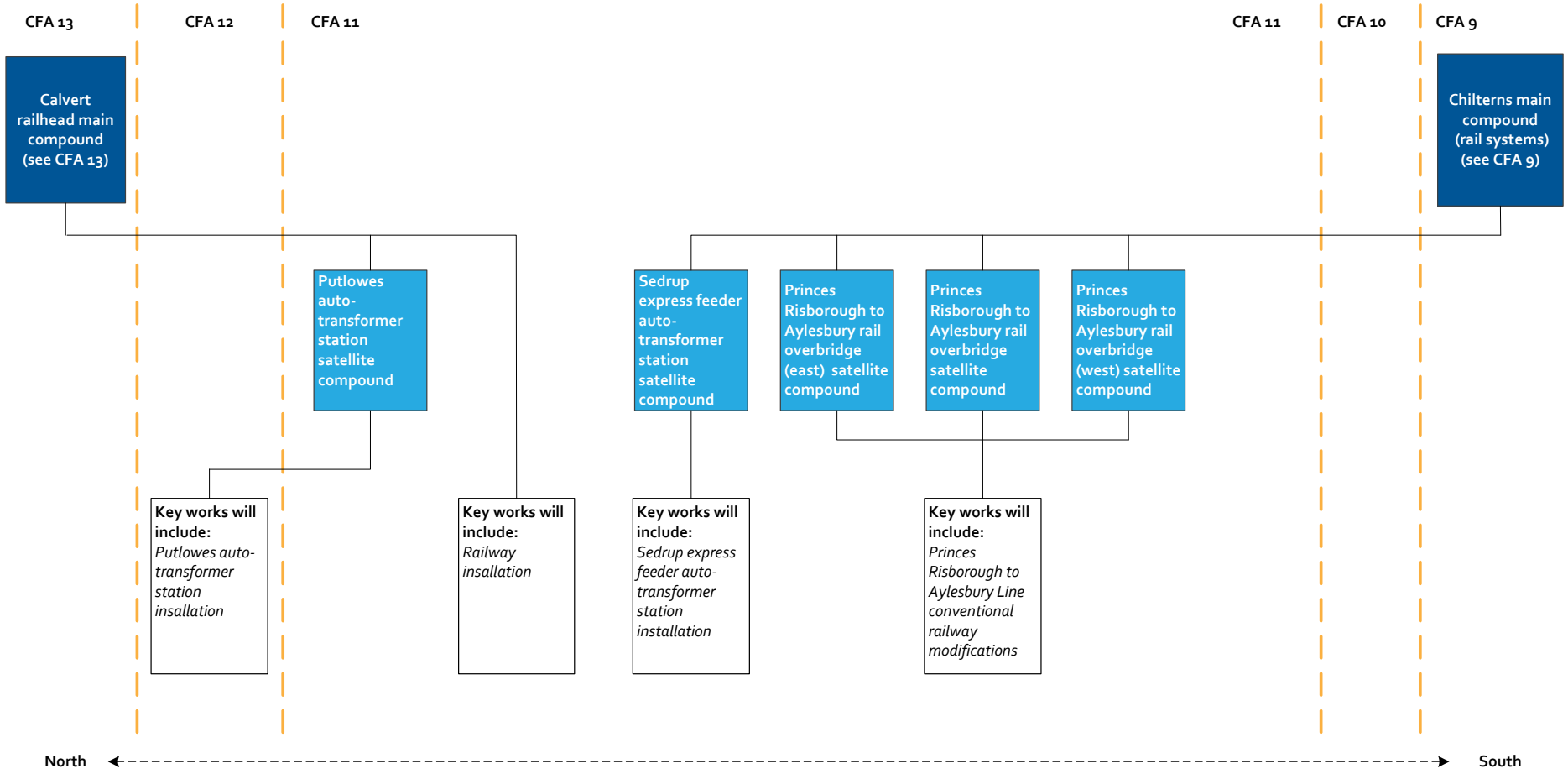


Figure 4: Schematic of construction compounds for railway installation works



Chilterns main compound (rail systems)

2.3.19 This compound is located within the Central Chilterns area (CFA9) but it will provide support to four railway installation works satellite construction compounds, as illustrated in Figure 4, which provide directly for the construction of the Proposed Scheme throughout this area. See CFA9 report for more information about this compound.

Small Dean viaduct main compound

2.3.20 This compound is located within the Dunsmore, Wendover and Halton area (CFA10), but it will provide support to one satellite construction compound in CFA11, as illustrated in Figure 3, which will provide directly for the construction of the Proposed Scheme between approximately south of Stoke Mandeville to Aylesbury. See CFA10 for more information on this compound.

Risborough Road satellite compound

2.3.21 This compound will be used for civil engineering works only, between south of Stoke Mandeville to Aylesbury. The compound will:

- be operational for approximately three years, commencing in 2017;
- support approximately 70 workers each day throughout much of the civil engineering works period; but will increase to approximately up to 155 workers each day during the peak period of activity;
- not provide worker accommodation facilities;
- be accessed via A4010 Risborough Road, A4010 Aylesbury Road to Princes Risborough and then either A4010 to High Wycombe and M40 and/or A4129, A418 to the M40 and/or A4010 Risborough Road, B4009 and A413 to the M40 via A355 and A40 or A40 to Denham and the M40; and
- be managed from the Small Dean viaduct main compound.

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

- site clearance and enabling works;
- building demolition;
- culverts and drainage;
- construction of bridges;
- cuttings, embankments and landscape earthworks;
- highway and footpath construction;
- permanent fencing; and
- landscaping and planting.

2.3.23 The compound will be used to manage construction of Stoke Mandeville south embankment and Aylesbury south cutting, which will take approximately three years and will include the A4010 Stoke Mandeville Bypass and overbridge, which will take one year and nine months. Volume 1, Section 5.2 provides a description of typical cuttings and embankments and Section 6.8 describes the associated construction techniques.

2.3.24 There will be one residential demolition, one commercial demolition and the loss of out buildings at one further residential property and one farm holding. Two pylons will also be demolished, together with the cemetery associated with the former site of the Church of St Mary's (see Table 1).

Table 1: Risborough Road satellite compound viaduct main compound demolitions

Description	Location
Community, the former site of the church of St Mary's and associated graveyard	Adjacent to Mill House Farm, off A4010 Risborough Road
Commercial property (One of the two buildings associated with Whitethorn Field Medi-Clinic)	Whitethorn Close
Outbuilding associated with 5 Whitethorn Close	Whitethorn Close
Two commercial farm (Whitethorn Farm) outbuildings	Off A4010 Risborough Road
Residential property (Elmfield, 30 Lower Road)	30 Lower Road, Stoke Mandeville
National Grid pylon	Adjacent to Footpath SMA/16
National Grid pylon	Adjacent to Footpath SBH/19

2.3.25 Diversion of three roads will be required:

- stopping up of A4010 Risborough Road and diversion via A4010 Stoke Mandeville bypass and B4333 Lower Road;
- stopping up of Old Risborough Road and diversion via A4010 Risborough Road, A4010 Stoke Mandeville bypass and B4333 Lower Road; and
- stopping up of Marsh Lane either side of the Proposed Scheme, with existing road retained in part to maintain access to the existing properties, and diversion via A4010 Stoke Mandeville bypass and B4333 Lower Road from the west.

2.3.26 Alternative routes for the following nine PRoW will be required:

- Footpath SMA/5 can remain open on its existing alignment until the new Risborough Road underpass is constructed and then can be permanently diverted onto new alignment adding an additional 400m. The new alignment can be open during remainder of construction phase;
- a temporary alternative route for Footpath ELL/20, to the east for a period of up to nine months, adding an additional 100m. It will then be permanently diverted 40m to the east across new Footpath ELL/20 overbridge, adding a negligible distance;

- a temporary alternative route for Footpath ELL/2, to the east for a period of approximately one year and six months to two years, adding an additional 400m. It will then be permanently reinstated along its original alignment, adding a negligible distance;
- a temporary alternative route for Footpath ELL/8, to the west for a period of approximately one year and six months to two years, adding an additional 400m. It will then be permanently reinstated along its original alignment, adding a negligible distance;
- a temporary alternative route for Footpath SMA/8, to the west for period of up to nine months, adding an additional 550m. It will then be permanently diverted 300m to the west across the new SMA/9 accommodation overbridge, adding an additional 400m;
- a temporary alternative route for Footpath SMA/9, to the west for a period of up to nine months, adding an additional 100m. It will then be permanently diverted 30m to the west across the new SMA/9 accommodation overbridge, adding a negligible distance;
- a temporary alternative route for Footpath SMA/11, to the east for a period of approximately one year six months to two years, adding an additional 600m. It will then be with a permanently diverted 150m to the west along A4010 Stoke Mandeville bypass overbridge, adding an additional 400m; and
- Footpath SMA/16 remains open during construction of the new Footpath SMA/16 accommodation overbridge. It will then be permanently diverted 30m to the east of its original alignment across the new overbridge.

2.3.27 Diversion of 14 utilities will be required, the key one being the temporary diversion of a 400kV National Grid overhead power line, for a period of up to one year, with permanent increase in overhead clearance and reinstatement along the original alignment.

2.3.28 Diversion of three watercourses will be required:

- permanent diversion of drainage ditch flowing parallel to Stoke Brook, which will require a diversion of approximately 80m to the south;
- The Stoke Brook main watercourse is to be permanently diverted through three culverts, two under the proposed route and one under the nearby footpath and embankment. Stoke Brook splits west of the proposed route and this secondary channel crosses the alignment three times. This channel is to be permanently diverted via a ditch on the west of the proposed route and crosses the alignment from west to east through a single culvert. Two tributaries of Stoke Brook are to be intercepted by drainage ditches either side of the HS2 alignment and permanently diverted along the modified route; and
- permanent diversion of a drain at Mill House Farm that will require a diversion of approximately 340m to the north.

Princes Risborough to Aylesbury rail overbridge satellite compound

2.3.29 This compound will be used for civil engineering and railway installation works, to the west of Stoke Mandeville and adjacent to the Princes Risborough to Aylesbury Line. The compound will:

- be operational for approximately two years and nine months, commencing in 2017, including rail installation works for approximately six months (the civil engineering and railway installation works will run concurrently at this satellite compound);
- support approximately 60 workers each day throughout much of the civil engineering works period; but will increase to approximately 130 workers each day during the peak period of activity; and support approximately 40 workers throughout the railway installation works, increasing to a maximum of 50 workers each day during the peak period of activity;
- not provide worker accommodation facilities;
- be accessed via M1 in the east at Milton Keynes, then onto the A421, the A4146 and A418 Oxford Road and/or M40, A41 from Bicester and A418 and/or M40, A418 Oxford Road. The final approach will then be along the site access road to the compound; and
- be managed from the A41 Bicester Road embankment main compound for the civil engineering works and from the Chilterns main compound (rail systems) (CFA9) for the railway installation works.

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

- site clearance and enabling works;
- embankments and landscape earthworks;
- railway realignment works;
- construction of an overbridge;
- permanent fencing; and
- landscaping and planting.

2.3.31 The compound will be used to manage construction of the Princes Risborough to Aylesbury rail overbridge (including rail realignment works), which will take approximately two years and nine months to construct. Volume 1, Section 5.10 describes a typical overbridge and Section 6.17 describes the associated construction activities.

2.3.32 A temporary closure of Footpath SMA/16 will be required, for a period of approximately one year and six months. It will then be permanently reinstated across the realigned Princes Risborough to Aylesbury Line level crossing, adding a negligible distance.

2.3.33 Key railway systems installation works in this section of the Proposed Scheme will be the Princes Risborough to Aylesbury Line realignment works. These works will be carried out in the following phases:

- Phase 1: civil engineering enabling works, including the construction of the new underbridge for the high speed line and construction of embankments to form the new alignment for the realigned Princes Risborough to Aylesbury Line. These works will be carried out during a combination of standard working hours and weekend track possessions;
- Phase 2: installation of new track and railway systems on the new bridge alignment and embankments. This will involve the positioning of rails and laying of new track along the new embankments. The majority of these works will take place during standard working hours, although some mid-week night possessions will be required for material delivery;
- Phase 3: weekend possessions to connect in to the existing Princes Risborough to Aylesbury Line at either end of the realignment works. The connections will be made in order that at the end of the series of weekend possessions, the operational rail traffic will use the new alignment, following testing and commissioning. Some overnight mid-week possessions may be required for preparation and follow up works associated with the weekend possessions;
- Phase 4: recovery of original Princes Risborough to Aylesbury Line using road rail vehicles to move sections of track in panels along the old embankments. This will be done during standard working hours, where the distance to the operation track allows this to be completed safely, or where not, during mid-week night possessions. The recovered track will be loaded onto rail vehicles for removal and disposal; and
- Phase 5: civil engineering works to remove the original alignment embankment to allow the cutting to be dug for the high speed line.

2.3.34 All the works described above will adopt standard techniques and sequencing that are widely available and known in the UK for railway construction. The works will be carried out from the existing Network Rail system and from the Princes Risborough to Aylesbury rail overbridge east and west satellite compounds established adjacent to the existing track, with limited access to the existing railway from adjacent highways.

Princes Risborough to Aylesbury rail overbridge satellite compound (west)/ Princes Risborough to Aylesbury rail overbridge satellite compound (east)

2.3.35 These two compounds will be used for railway systems installation works only, to the west of Stoke Mandeville and adjacent to the Princes Risborough to Aylesbury Line. Each compound will:

- be operational for approximately nine months, commencing in 2018;
- support approximately 20 workers throughout the railway installation works but will increase to a maximum of 25 workers each day during the peak period of activity; and

- will be managed from Chilterns main compound (rail systems) (CFA9).

2.3.36 The Princes Risborough to Aylesbury rail overbridge satellite compound (east) will be accessed via the railway line or via the Princes Risborough to Aylesbury rail overbridge satellite compound. The Princes Risborough to Aylesbury rail overbridge satellite compound (west) will be accessed via the existing Princes Risborough to Aylesbury Line only.

2.3.37 Key railway systems installation works in this section of the Proposed Scheme will be the Princes Risborough to Aylesbury Line realignment works. See description of associated works under Princes Risborough to Aylesbury rail overbridge satellite compound.

A418 Oxford Road overbridge satellite compound and Sedrup express feeder auto-transformer station satellite compound

2.3.38 This compound will be used for civil engineering and railway installation works, adjacent to the west of Aylesbury. After the civil engineering works are completed, the A418 Oxford Road overbridge satellite compound will reduce in size to form the Sedrup express feeder auto-transformer station satellite compound for the railway installation works. The compound will:

- be in place for six years and three months. During this period there will be civil engineering works for approximately two years and nine months, starting in 2018, followed by a two year period of inactivity before the railway installation works, which will last for approximately one year and six months, commencing in 2023;
- support approximately 55 workers each day throughout much of the civil engineering works period; increasing to a maximum of190 workers each day during the peak period of activity; and support approximately 30 workers throughout the railway installation works, increasing to a maximum of 40 workers each day during the peak period of activity;
- not provide worker accommodation facilities;
- be accessed via the M1 from the east at Milton Keynes, continuing on to A421, and joining A4146 and ending on A418 Oxford Road. Alternatively, the route will be from the M40 on to the A418 Thame Road via Thame, continuing on the A418 Aylesbury and ending at the A418 Oxford Road and/or the M40, A41 via Bicester and Aylesbury to join the A418 from the west;
- have an associated roadhead for the receipt, storage and transfer of earthworks material route-wide (see Map CT-05-043 to CT-05-044, Volume 2, CFA11 Map Book); and
- be managed from the A41 Bicester Road embankment main compound for the civil engineering works and from the Chilterns main compound (rail systems) (CFA9) for the railway installation works.

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

- site clearance and enabling works;
- building demolition;
- culverts and drainage;
- construction of bridges;
- cuttings, embankments and landscape earthworks;
- highway and footpath construction;
- permanent fencing;
- railway systems installation; and
- landscaping and planting.

2.3.40 The A418 Oxford Road overbridge satellite compound will be used to manage construction of Aylesbury south embankment and Aylesbury north cutting, which will take approximately two years and nine months. Volume 1, Section 5.2 provides a description of typical cuttings and embankments and Section 6.8 describes the associated construction techniques.

2.3.41 Demolition will be required at one property and one structure:

- residential property, off A418 Oxford Road, Glebe House (Grade II listed) and its two associated outbuildings; and
- three sections of the curtilage wall associated with Hartwell House (Grade I listed), adjacent to A418 Oxford Road.

2.3.42 Diversion of one road will be required comprising the permanent diversion of A418 Oxford Road, 150m to the east, across the new overbridge.

2.3.43 Alternative routes for the following four PRoW will be required:

- a temporary alternative route for Footpath SBH/19, to the east for a period of up to nine months, adding an additional 100m. It will then be permanently reinstated along the new Bridleway SBH/19 overbridge along its original alignment, adding a negligible distance;
- a temporary alternative route for Footpath SBH/27, to the west for a period of up to nine months. It will then be permanently reinstated across Bridleway SBH/27 overbridge along its original alignment;
- a temporary alternative route for Footpath SBH/34, to the east for a period of up to nine months, adding an additional 100m. It will then be permanently reinstated across the Footpath SBH/34 accommodation overbridge along its original alignment, adding a negligible distance; and
- a temporary alternative route for Footpath SBH/32, to the west for a period of up to nine months, adding an additional 100m. It will then be permanently reinstated across the new Footpath SBH/32 overbridge along its original alignment, adding a negligible distance.

2.3.44 Temporary diversion of the private access to Whaddon Hill Farm will be required during the upgrading of the access track and construction of Bridleway SBH/2 overbridge.

2.3.45 Diversion of two utilities and the installation of two new utilities will be required, the key ones being:

- permanent diversion of Southern Gas Network high pressure gas mains across the field off Footpath SBH/34/1, 30m to the west from existing alignment; and
- permanent new UK Power Networks overhead lines, connecting electricity to the Proposed Scheme at Sedrup express feeder auto-transformer station.

2.3.46 Diversion of four watercourses will be required:

- permanent realignment of the drain at Rifle Spinney, which will require a diversion of approximately 20m to the north;
- permanent realignment of the Lower Hartwell drain at Rifle Spinney, which will require a diversion of approximately 100m to the north;
- permanent realignment of the drain at Lower Hartwell, which will require a diversion of approximately 70m to the north; and
- permanent realignment of the drain at Aylesbury Park Golf Club, which will require a diversion of approximately 160m to the north.

2.3.47 Key railway systems installation works in this section of the Proposed Scheme will be the installation of Sedrup express feeder auto-transformer station. Volume 1, Section 5.17 describes the typical power supply and Section 6.23 describes the associated construction activities.

Thame Valley viaduct satellite compound

2.3.48 This compound will be used for civil engineering works only to the north-west of Aylesbury. The compound will:

- be operational for approximately two years and six months, commencing in 2018;
- support approximately 95 workers each day throughout much of the civil engineering works period, increasing to up to approximately 150 workers each day during the peak period of activity;
- not provide worker accommodation facilities;
- be accessed via the M1 from the east at Milton Keynes, continuing onto the A421, the A4146, the A418 to Aylesbury and then the A41 Bicester Road and/or via the M40, A41 from Bicester and/or the M40, A418 Oxford Road to Aylesbury then the A41. The final approach will be along the site access road to the compound; and
- be managed from the A41 Bicester Road embankment main compound.

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

- site clearance and enabling works;
- construction of viaduct;
- construction of bridges;
- cuttings, embankments and landscape earthworks;
- drainage;
- footpath and accommodation access construction;
- permanent fencing; and
- landscaping and planting.

2.3.50 The Thame Valley viaduct satellite compound will be used to manage construction of the Thame Valley viaduct and adjacent earthworks, which will take approximately two years and six months. Volume 1, Section 5.9 describes a typical viaduct and Section 6.16 describes the associated construction activities.

2.3.51 No demolitions or road diversions will be required.

2.3.52 An alternative route for Footpath SBH/2 will be required, to the west for a period of up to nine months, adding a negligible distance. It will then be permanently diverted 50m to the west across the new Bridleway SBH/2 overbridge, adding a negligible distance.

2.3.53 Diversion of four utilities will be required, the key one being the permanent realignment of Government Pipelines and Storage System (GPSS) oil pipelines, 60m to the east from the existing alignment.

2.3.54 Diversion of two watercourses will be required:

- permanent realignment of the drain at Putlowes South, which will require a diversion of approximately 300m to the south; and
- permanent realignment of the drain at Putlowes, which will require a diversion of approximately 100m to the south.

A41 Bicester Road embankment main compound/Putlowes auto-transformer station satellite compound

2.3.55 This compound will be used for civil engineering and railway installation works, between north-west of Aylesbury and the A41 Bicester Road. This compound also manages work in CFA12. After the civil engineering works are complete, this main compound will reduce in size to form the Putlowes auto-transformer station satellite compound for the railway installation phase of works. The compound will:

- be in place for seven years. During this period there will be civil engineering works for approximately three years and nine months, starting in 2017, followed by a one year and nine month period of inactivity before the railway installation works, which will last for approximately one year and six months,

commence in 2023;

- support approximately 60 workers each day throughout much of the civil engineering works period, but will increase to a maximum of 100 workers each day during the peak period of activity; and support approximately 30 workers each day throughout the railway installation works period, with a maximum of 40 workers each day during the peak period of activity;
- provide living accommodation for between approximately 60 to 200 people for an estimated period of three years and six months;
- be accessed via the M1 from the east at Milton Keynes, continuing on to A421, the A4146, the A418 to Aylesbury and then ending at the A41 Bicester Road and/or the M40 from the west via A41 from Bicester and/or the M40, A418 to Aylesbury then A41 Bicester Road;
- provide main compound support to five satellite compounds, as illustrated in Figure 3, for the civil engineering works;
- have an associated roadhead for the receipt, storage and transfer of earthworks material route-wide. The area identified for the roadhead is located in Waddesdon and Quainton area (CFA12)(see Map CT-05-047a, Volume 2, CFA12 Map Book); and
- be managed from the Calvert railhead main compound for the railway systems installation works.

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

- site clearance and enabling works;
- culverts and drainage;
- embankment and landscaping earthworks;
- construction of bridges;
- footpath construction and reinstatement;
- permanent fencing; and
- landscaping and planting.

2.3.57 The compound will be used to manage construction of the A41 Bicester Road embankment, which will take approximately two years and six months. Volume 1, Section 5.2 provides a description of a typical embankment and Section 6.8 describes the associated construction techniques.

2.3.58 No demolitions, road or utility diversions will be required.

2.3.59 Alternative routes for the following two PRoW will be required

- Bridleway FMA/1 remains open during construction. It will then be permanently diverted approximately 300m to the west across the new

Bridleway FMA/1 accommodation overbridge, adding an additional 900m; and

- a temporary alternative route for Footpath FMA/2, to the west for a period of approximately six months, adding a negligible distance. It will then be diverted reinstated across the new Bridleway FMA/1 accommodation overbridge, adding an additional 200m.

2.3.60 Diversion of two watercourses will be required comprising the permanent realignment of the two drains at A41/Old Rectory Cottage, which will require a diversion of approximately 300m the north via the Fleet Marston culvert.

2.3.61 Key railway systems installation works will include the installation of the Putlowes auto-transformer station in the Waddesdon and Quainton area (CFA12). See CFA12 for more information about these works.

Calvert railhead main compound

2.3.62 This compound is located within the Calvert, Twyford and Chetwode area (CFA13), but it will provide support to all railway installation works and one satellite construction compound, as illustrated in Figure 4, which provide directly for the construction of the Proposed Scheme throughout this area.

2.3.63 The railway installation works will include track, overhead line equipment, communications equipment and traction power supply. The installation of track in open areas will be of standard ballast or slab track configuration. Volume 1, Section 5 describes typical track layout and Section 6.22 describes the associated construction activities.

2.3.64 Works in this area will take approximately one year and six months, starting in 2023.

2.3.65 The track will be laid in a southerly direction away from the Calvert railhead main compound in this area. Before the railway installation can commence, adequate civil engineering work will need to be completed to allow a continuous track laying sequence.

2.3.66 The railway systems installation has its own mobile welfare facilities for the site staff.

Construction waste and material resources

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

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

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

2.3.70 The quantity of surplus excavated material originating from the Stoke Mandeville and Aylesbury area that will require off-site disposal to landfill as excavation waste is shown in Table 2. This is the forecast quantity of contaminated excavated material that is chemically unsuitable for reuse within the Proposed Scheme and which will be taken directly from the Stoke Mandeville and Aylesbury area for off-site disposal to either non-hazardous or hazardous landfill. This represents a proportion of the total quantity of surplus excavated material that will require disposal which altogether is reported on a route-wide basis in Volume 3, Section 14.

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

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

2.3.72 The quantities of estimated construction, demolition and excavation wastes that will require off-site disposal to landfill are shown in Table 2.

Table 2: Estimated construction demolition and excavation waste

Waste type	Estimated material quantities that will be generated (tonnes)	Estimated quantity of waste for off-site disposal to landfill (tonnes)
Excavation	2,841,551	22,163
Demolition	3,251	325
Construction	29,766	2,977
Worker accommodation site	78	39
TOTAL	**2,874,646**	**25,504**

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

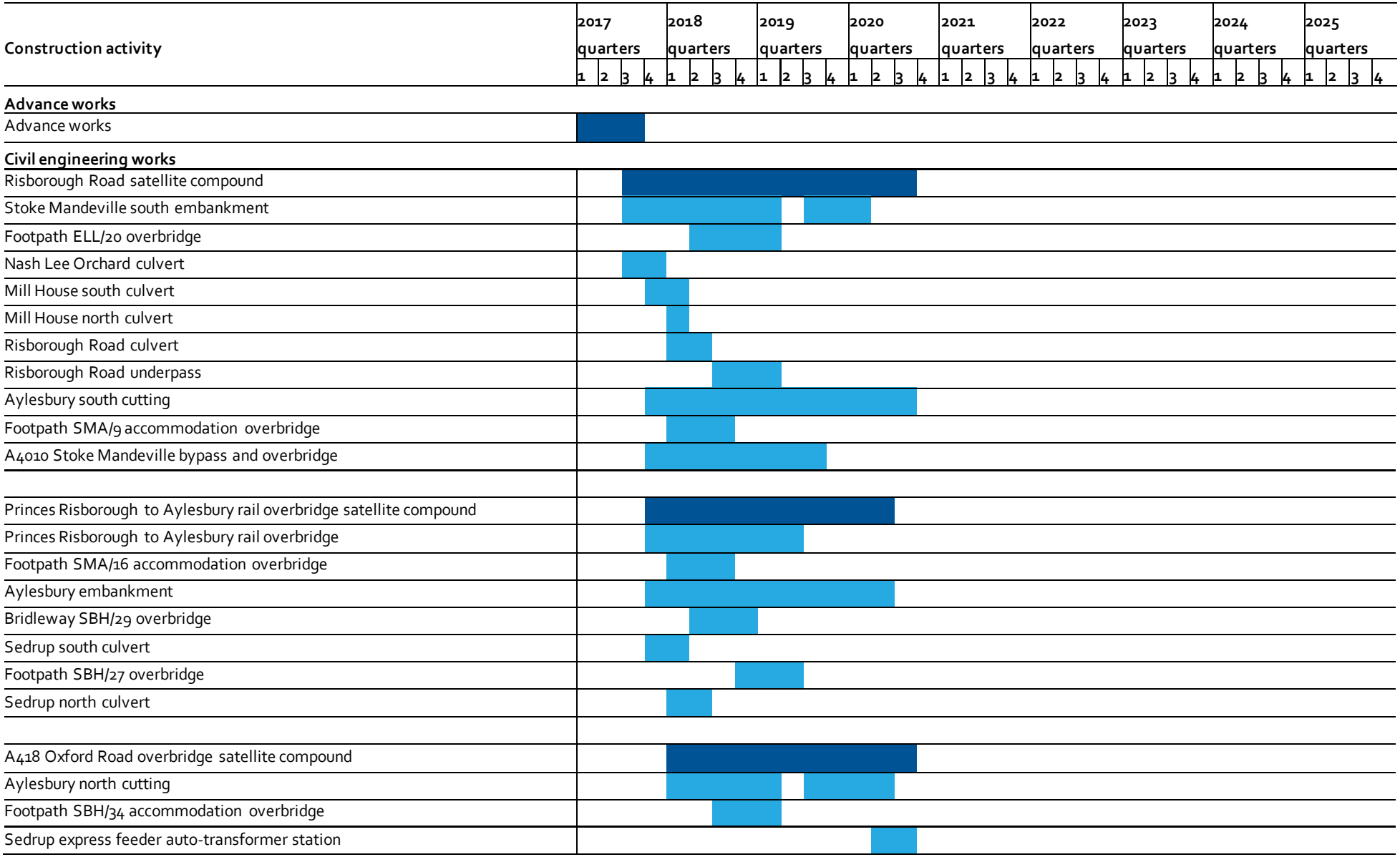
Commissioning of the railway

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

Construction programme

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

Figure 5: Indicative construction programme



A418 Oxford Road overbridge	
Oxford Road embankment	
Lower Hartwell No.1 culvert	
Footpath SBH/32 overbridge	
Lower Hartwell No.2 culvert	
Lower Hartwell No.3 culvert	
Whaddon Hill cutting	
Bridleway SBH/2 overbridge	
Thame Valley viaduct satellite compound	
Thame Valley south embankment	
Thame Valley viaduct	
Thame Valley north embankment	
Putlowes cutting	
Putlowes accommodation overbridge	
A41 Bicester Road embankment main compound	
Bicester Road embankment	
Fleet Marston culvert	
Bridleway FMA/1 accommodation overbridge	
Cranwell Farm culvert	
Rail infrastructure and systems works	
Calvert railhead main compound	See CFA13
High speed railway installation	
Chilterns main compound (rail systems)	See CFA9
Princes Risborough to Aylesbury rail overbridge satellite compound	
Princes Risborough to Aylesbury conventional railway modifications	
Princes Risborough to Aylesbury Line satellite compound (west)	
Princes Risborough to Aylesbury conventional railway modifications	
Princes Risborough to Aylesbury Line satellite compound (east)	
Princes Risborough to Aylesbury conventional railway modifications	
Sedrup express feeder auto-transformer station satellite compound	
Sedrup express feeder auto-transformer station installation	

Putlowes auto-transformer station satellite compound	

Commissioning

Commissioning (until end 2026)	

Key **Construction works** **Compound duration**

2.4 Operation of the Proposed Scheme

Operational specification

2.4.1 Volume 1, Section 4.3 describes the envisaged operational characteristics of Phase One of HS2 as a whole and how they may change when Phase Two is also operational.

HS2 services

2.4.2 It is anticipated that initially there would be 11 tph each way passing through the Stoke Mandeville and Aylesbury area in the morning and evening peak hours, and fewer during other times. The first trains of the day would leave the terminus stations no earlier than 05:00 Monday to Saturday (and 08:00 on Sundays) and the last would arrive no later than midnight.

2.4.3 It is anticipated that with Phase One in place the frequency of services could rise to 14 tph each way during peak hours, and that with Phase Two in place the frequency could rise to 18 tph each way during peak hours. The assessment of sound, noise and vibration has taken into account the frequency during Phase Two.

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

Maintenance

2.4.5 Volume 1, Section 4.3 describes the maintenance regime for the Proposed Scheme.

2.4.6 The intention is that inspections of the route will take place on a regular basis at night when the railway is not operating. There will be routine preventative maintenance, including grinding and milling of the rails to keep them in good condition, and more periodic heavy maintenance as necessary.

2.4.7 Railway maintenance vehicles would be parked either at the Calvert infrastructure maintenance depot, or in the defined maintenance loops along the route. For this area the nearest maintenance loops will be to the south of A4010 Risborough Road, near Stoke Mandeville. The maintenance loops could also be used in the case that a passenger train could not continue unassisted to its destination.

Operational waste and material resources

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

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

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

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

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

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

2.4.13 On this basis, approximately 156 tonnes of operational waste will be re-used, recycled and recovered during each year of operation of the Proposed Scheme in the Stoke Mandeville and Aylesbury area. Approximately 32 tonnes will require disposal to landfill (see Table 3).

Table 3: Operational waste forecast for the Proposed Scheme

Waste source	Estimated quantity of waste generated per annum (tonnes)	Estimated quantity of waste for disposal to landfill per annum (tonnes)
Railway station and train	0	0
Rolling stock maintenance	0	0
Track maintenance	173	26
Ancillary infrastructure	15	6
TOTAL	188	32

2.4.14 The assessment of the likely significant environmental effects associated with the disposal of operational waste has been undertaken for the Proposed Scheme as a whole (see Volume 3, Section 14).

2.5 Community forum engagement

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

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

- 4 April 2012 at the Mandeville School Conference Room;

- 5 July 2012 at the Mandeville School Conference Room;
- 11 September 2012 at the Mandeville School Conference Room;
- 14 November 2012 at the Mandeville School Conference Room;
- 13 February 2013 at Booker Park School; and
- 10 September 2013 at Aylesbury Multi-cultural Centre.

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

2.5.4 The main themes to emerge from these meetings were:

- potential impacts on residents from the realignment of roads, particularly A4010 Risborough Road and A418 Oxford Road;
- the concern that properties on the southern edge of Aylesbury would be disproportionally affected especially for those living around the Hawkslade Estate because the proposed railway would be close to or above ground level;
- potential implications for existing planning proposals, such as Fairford Lees;
- potential impacts on heritage sites in the area, namely Stoke Mandeville Old Church, Stoke Mandeville deserted village and Hartwell House;
- potential impacts on Aylesbury Vale Golf Club and its role as a community resource;
- potential impact on the River Thame, due to run-off from construction activities and from the operation of trains, and the impact on floodplains in the area;
- potential visual impact on those who live or run businesses in the area;
- the mitigation for those living close to the route and those living in the vicinity of the maintenance loop;
- the proposed locations of some construction sites, in particular those in the vicinity of local schools; and
- concerns over the implications of alternative community proposals upon residents within this area.

2.5.5 In addition to the engagement through the community forums, the draft ES and design refinement consultations were launched on 16 May 2013 for a period of eight weeks and closed on the 11 July 2013. As part of these consultations, members of local communities and other interested parties were notified, provided with information and invited to engage on issues pertinent to the draft ES and the development of the Proposed Scheme. Details of the local consultation events were provided on HS2 Ltd website, social media, posters at local venues, national and regional advertising and to properties within 1km of the Proposed Scheme. In the Stoke Mandeville and Aylesbury area consultations on the draft ES and on the design refinement were held on the 24 June 2013 at Stoke Mandeville Stadium.

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

2.5.7 Responses from the draft ES consultation have been analysed and an overview of those received and how the ES has taken account of responses is contained in the Draft Environmental Statement Consultation Summary Report (Volume 5: Appendix CT-008-000).

2.6 Route section main alternatives

2.6.1 The main strategic alternatives to the Proposed Scheme are presented in Volume 1. The main local alternatives considered for the Proposed Scheme within this area are described in this section.

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

Maintenance loop at Stoke Mandeville

2.6.3 As part of the development of the design and the operational requirements for the railway, a need was identified for two maintenance loops between London and Birmingham as part of the Proposed Scheme. One loop is required between London and the infrastructure maintenance depot at Calvert; and one between Calvert and Birmingham. The loops will be used to stable maintenance trains and are necessary to achieve reliable performance and to undertake railway maintenance activities. The choice of locations for the maintenance loop was constrained by the need for a relatively flat and straight section of track for the length of the loop. Further, the locations needed to be an approximately equal distance from both London and Birmingham and the infrastructure maintenance depot at Calvert.

2.6.4 Maintenance loops were not included in the January 2012 announced scheme.

2.6.5 Four options were evaluated for the siting of the maintenance loop between London and the infrastructure maintenance depot at Calvert:

- Option A: located between Grim's Ditch and Wendover Dean in the Chilterns AONB;
- Option B: The Proposed Scheme, located south of the A4010 Risborough Road, Stoke Mandeville;
- Option C: located at Hyde Heath, between the Chilterns tunnel and the South Heath green tunnel in the Chilterns AONB; and
- Option D: located at Denham, close to the M25.

2.6.6 Option D was not progressed because Denham is also the proposed site for the potential link to Heathrow. This link would use the only section of straight track near the south entrance to the Chilterns tunnel and so it was not feasible to include the maintenance loop at this location as well. Option C was not progressed further because the Hyde Heath site could not accommodate the track gradients required for a maintenance loop. In addition, neither Option C or D would allow the loop lines to be connected to both sides of the main line, an operational requirement. Option C and D were discounted at an early design stage and so have not been assessed environmentally.

2.6.7 Options A and B were evaluated and both would give rise to potentially adverse environmental impacts including visual, cultural heritage, noise and biodiversity.

2.6.8 Option A would have required the route at that location to be moved horizontally by approximately 100m from the January 2012 announced scheme alignment. This would affect the vertical levels of the railway with deeper cuttings near South Heath and would require an increase in the elevation of the southern end of the Wendover Dean viaduct by around one metre. As a result, this option would also be located slightly closer to dwellings on Potter Row. There would also be impacts on Grim's Ditch scheduled monument, an area of ancient woodland at Jones' Hill Wood, and there would be additional visual impacts on the AONB, in particular, resulting from, additional rail infrastructure within the designated area.

2.6.9 Option B, at Stoke Mandeville, will be located between Nash Lee Road and the A4010 Risborough Road and will meet maintenance requirements for good local road access. No horizontal realignment has been required to accommodate the loops on this site, but to provide a relatively flat gradient through the loops the northern end of the Wendover green tunnel has been lowered into deeper cutting by approximately 1m and the rail embankment approach to A4010 Risborough Road raised by approximately 4m. When this alternative was evaluated this would have resulted in a corresponding increase in the diverted Risborough Road embankment and bridge which would have been lifted by up to 15m above ground level. This would have increased visual impacts on adjacent properties and resulted in some minor visual, noise and air quality impacts for local receptors, including the Grade II listed Stoke House. However, these visual impacts have largely been avoided through subsequent changes to the reinstatement of A4010 Risborough Road; further details are provided in the alternative section on Stoke Mandeville bypass.

2.6.10 Placing the maintenance loops at Stoke Mandeville will impact upon known and unknown archaeology around the former site of the Church of St Mary's that would be within the footprint of the maintenance loop and the associated access road. This location is also in an area of floodplain and so placing the maintenance loop at this location will also have impacts on aquatic habitat. An area of mitigation for flood water and biodiversity has been included to the west of the route to address these matters.

2.6.11 Option B was considered to provide the best overall environmental outcome. Further, the subsequent development of the A4010 Stoke Mandeville Bypass option has removed the need for the A4010 Risborough Road realignment and overbridge reducing the impacts of Option B.

2.6.12 For these reasons Option B has been adopted in the Proposed Scheme.

Stoke Mandeville bypass

2.6.13 The Proposed Scheme includes an extended realignment of the A4010 Risborough Road with a single crossing over the railway, referred to as Stoke Mandeville bypass.

2.6.14 Previously the Draft ES and the January 2012 announced route included two new bridges and embankments to take both the A4010 Risborough Road and Marsh Lane over the route at Stoke Mandeville.

2.6.15 Stoke Mandeville Parish Council proposed an alternative option to remove these road crossings in the form of a bypass to the west of Stoke Mandeville. This has subsequently been taken forward by Buckinghamshire County Council and is also supported in proposals put forward by the National Trust.

2.6.16 HS2 Ltd has been in discussion with Buckinghamshire County Council about the merits of a bypass. There is local support for the bypass as this will avoid the environmental effects that would be associated in particular with an A4010 Risborough Road overbridge.

2.6.17 Three options were evaluated:

- Option A: The January 2012 announced scheme, comprising an offline reinstatement of the A4010 Risborough Road over the route and an online reinstatement of Marsh Lane over the route;
- Option B: A bypass passing to the west of Stoke Mandeville diverting off the existing North Lee Lane, north of North Lee, crossing agricultural land in a northerly direction before running parallel to the west of HS2. The bypass would cross the route on an overbridge to the south of the Princes Risborough to Aylesbury Line. The bypass would tie in with B4443 Lower Road via a roundabout between Aylesbury and Stoke Mandeville; and
- Option C: The Proposed Scheme, a bypass passing to the west of Stoke Mandeville diverting off the existing A4010 Risborough Road between North Lee and Old Risborough Road. The bypass will continue parallel with the route before traversing over the route to the south of the Princes Risborough to

Aylesbury Line. The bypass joins to the B4443 Lower Road, to the south of Aylesbury, via a new roundabout.

2.6.18 Option A was included in the January 2012 announced scheme and the draft ES. Option A would require the construction of two significantly higher bridges in comparison to just the one lower bridge for Options B and C. This would result in adverse effects on the properties along parts of the A4010 Risborough Road and within Stoke Mandeville, visually and as a result of the noise impacts arising from traffic along the A4010 Risborough Road crossing over the route. In addition there would be adverse effects to the setting of two Grade II listed buildings. Option A would also require the demolition of two residential properties to enable the construction of the A4010 Risborough Road overbridge. It was for these reasons that Option A was no longer adopted in the Proposed Scheme.

2.6.19 Compared with Option A, neither Option B nor C would require the construction of the two high overbridges for the A4010 Risborough Road and Marsh Lane. Instead, Option B and C would have one lower bridge adjacent to the Princes Risborough to Aylesbury Line. This will help alleviate the environmental effects otherwise arising from existing traffic along the A4010 Risborough Road travelling at height past residential areas in addition to re-directing traffic passing through Stoke Mandeville. Options B and C remove the need to demolish two properties, The Lodge and New Cottage, but would result in the demolition of a residential property, 'Elmfield', 30 Lower Road, as a result of the tie in roundabout on B4443 Lower Road.

2.6.20 Compared with Option C, Option B would cross over a larger proportion of agricultural land as well as creating new noise impacts on the hamlet of North Lee. It was for these reasons that Option B was not adopted into the Proposed Scheme.

2.6.21 Both Options B and C remove traffic from the centre of Stoke Mandeville and provide swifter access to Stoke Mandeville hospital. Option C in comparison to Option B will continue parallel with the route for a longer distance and so will be less visually intrusive as well as severing less agricultural land. It is shorter in distance and so will take less time to construct in addition to being not as costly as Option B.

2.6.22 For these reasons Option C has been adopted in the Proposed Scheme.

Tunnel past Aylesbury

2.6.23 The Proposed Scheme will pass along the western side of Aylesbury close to existing ground level in a series of shallow cuttings and embankments. The Proposed Scheme is similar to the January 2012 announced scheme. Alternatives to the Proposed Scheme were put forward by the local community for this section of the route.

2.6.24 The options considered were:

- Option A: The Proposed Scheme consisting of shallow cutting and embankment (based on the January 2012 announced scheme);
- Option B: A green ('cut and cover') tunnel for the section of route past Aylesbury; and
- Option C: A bored tunnel for the section of route passing Aylesbury.

2.6.25 The tunnel options were proposed by the Stoke Mandeville and Aylesbury community forum in order to provide additional noise and visual mitigation for the communities within Aylesbury that would be close to the proposed railway and to reduce impacts on Hartwell House.

2.6.26 The route through this area would cross a number of water courses and Option A will cross over these water bodies on embankments with culverts for the water to pass underneath. To construct Option B, the alignment would either have to be sufficiently deep so that the watercourses could be reinstated over the top, or an alternative drainage arrangement would need to be installed underneath the tunnel in conjunction with some lowering of the alignment.

2.6.27 In order to lower the alignment sufficiently to allow the watercourses to be reinstated over the top of the tunnel, whilst complying with engineering requirements, the route would have to be lowered over an extended distance. This would increase the volume of excavated material generated, worsen impacts such as the loss of habitat and property and in turn increase the cost of the project. For these reasons, a design for a 'cut and cover' tunnel, (Option B) was not adopted in the Proposed Scheme.

2.6.28 The alternative of installing drainage underneath a green tunnel would be likely to require the use of siphons to take the water underneath the tunnel. This would raise a number of health and safety and maintenance issues. As a result siphons are generally not considered a satisfactory solution. Due to the artificial nature of these engineered structures there would also be ecological and potential flood risk issues associated with this approach.

2.6.29 Even using a siphon there would still be a need for lowering of the alignment to address visual impacts and landscape integration and this would increase the volume of excavated material and in turn, the cost of the project under Option B. For these reasons Option B was not adopted in the Proposed Scheme.

2.6.30 Providing a bored tunnel past Aylesbury (Option C) would require a tunnel length of over 5km, with the route further lowered on the tunnel approaches to achieve the necessary minimum depth between the tunnel and the ground. Due to the tunnel length an intervention shaft with associated ventilation equipment would be required.

2.6.31 The tunnel portal locations would be constrained at the southern end by the need to maintain levels across the A4010 Risborough Road; at the northern portal the lowered route would conflict with the River Thame flood plain and would either require extensive flood protection works or acceptance of a shorter tunnel.

2.6.32 Whilst a bored tunnel would provide effective noise and visual mitigation to Aylesbury, there would be extensive impacts at the tunnel portal during construction and permanent facilities and access required for emergency services. The approach cuttings to the portals would increase landtake required in these areas and would require additional drainage and flood protection works. Construction costs would be significantly more than for Option A.

2.6.33 It is acknowledged that visual and noise benefits could be achieved through lowering the line into a 'cut and cover' or bored tunnel as proposed under Option B or Option C compared with Option A. However, the Proposed Scheme, Option A, has been designed to include landscaped earthworks and noise fence barriers adjacent to the route, which will provide visual screening and will help reduce noise effects.

2.6.34 For these reasons Option A has been adopted in the Proposed Scheme.

Alignment between Stoke Mandeville and Aylesbury

2.6.35 Adjacent to Stoke Mandeville and Aylesbury the Proposed Scheme will be close to existing ground level in a series of shallow cuttings and embankments. This is similar to the January 2012 announced scheme.

2.6.36 As an alternative to creating a green tunnel or bored tunnel, as outlined above, the Stoke Mandeville and Aylesbury community forum (see Section 2.5), proposed a further option of lowering the alignment adjacent to Stoke Mandeville and Aylesbury.

2.6.37 The community forum considered that lowering the railway would reduce the potential visual impacts and noise effects from the proposed railway. It was also suggested that this would enable the size and height of the bridges and PRoW crossings to be reduced, such that there would not be a significant increase in cost.

2.6.38 The same constraints and considerations apply to lowering the alignment as were described above for a green tunnel through this area. In particular, lowering the alignment would increase the excavated material generated and would add to the cost of the Proposed Scheme. Further, if the railway was lowered the watercourses would have to pass underneath the cutting. This may require the use of siphons, which raises a number of health and safety and maintenance issues. In general siphons are not considered a satisfactory solution for these reasons but there would also be ecological and potential flood risk issues associated with their use.

2.6.39 For these reasons a lowering of the alignment has not been adopted in the Proposed Scheme.

Hartwell House National Trust Proposals

2.6.40 The Proposed Scheme adjacent to Aylesbury and past Hartwell House will be on a series of low embankments, shallow cutting or close to the surface. The A418 Oxford Road across the railway would be realigned on an overbridge south of its existing position.

2.6.41 The alignment of the Proposed Scheme is similar to the January 2012 announced scheme, except for the reinstatement of the A418 Oxford Road on a changed alignment.

2.6.42 The National Trust has taken the opportunity to engage with HS2 Ltd and early on came forward to discuss their concerns about the proposals for the Proposed Scheme between the Chilterns AONB and Waddesdon. The Trust has presented its ideas for the route, its proximity to people and property and has offered its view on land use planning in proximity to the Proposed Scheme. That view has been informed by its independent analysis and its local consultation with people and authorities in the Aylesbury area.

2.6.43 HS2 Ltd has taken account of the National Trust's concerns and therefore, the Proposed Scheme for this area includes proposals for similar patterns of landscape and planting design, sound attenuation and the position of the realignment of the A418 Oxford Road overbridge. The detailed design of the mitigation proposals through this section of the route will continue to be developed in response to consultation with the National Trust.

2.6.44 The noise assessment has identified additional mitigation measures that will be provided for properties closest to the route at Aylesbury. These will include further conventional measures to attenuate noise, such as noise fence barriers, and carefully positioned landscaped earthworks and planting similar to those proposed by the Trust.

2.6.45 The National Trust put forward several proposals including options for a land bridge at Hartwell House. Three options were evaluated:

- Option A: The Proposed Scheme, (based on the January 2012 announced scheme), comprising 2.3km of embankments and cuttings with the offline reinstatement of the A418 Oxford Road over the route;
- Option B: A 2.3km long cut-and-cover land bridge beginning from the proposed Welland Close Footbridge (SBH/27 overbridge), to the west of Aylesbury and finishing to the north of the historic avenue, north of Hartwell House. Although a National Trust option, this option had to be re-engineered to meet engineering standards; and
- Option C: A 0.9km long cut-and-cover land bridge beginning just to the south of the realigned A418 Oxford Road and finishing at where the Lower Hartwell public footpath crosses the route. Although a National Trust option, this option also had to be re-engineered to meet engineering standards.

2.6.46 A cut-and-cover land bridge was proposed to achieve the National Trust's aim of maintaining the natural heritage of the area; however both land bridge options would have some adverse effects during construction. The land bridge is in effect a tunnel and requires wider track spacing than in open sections (i.e. Option A). This and the associated tunnel works would increase the width of the corridor of land required for construction of the Proposed Scheme from approximately 60m for an open cut to approximately 100m for a cut-and-cover land bridge. This additional land required for the construction of the Proposed Scheme would result in the loss of a larger area of trees at Rifle Spinney and create more open views from Grade I Hartwell House compared with Option A, with a permanent adverse visual impacts along the main avenue. There would also be the permanent loss of an historic feature through the removal of an additional 40m of the curtilage wall compared with Option A. A greater working corridor width would also require the demolition of a further residential property in addition to the Grade II listed Glebe House as well as further impacts on the Aylesbury Park Golf Club, should this facility be able to continue to operate in their current location.

2.6.47 It is recognised that there would also be benefits in terms of reduced severance to the Hartwell House from either cut-and-cover land bridge. Landscape restoration over the cut-and-cover land bridge would help screen the proposed scheme and integrate it into the adjacent landscape. Land could be restored to pre-existing conditions and/or planted to provide better habitat connectivity. There would also be reduced noise impacts on sensitive receptors such as Hartwell House and St Mary's Church. However, these options would not avoid the potential noise effects for receptors closest to the route at Aylesbury, as the location of the tunnel would not correspond with the section of route where the greatest numbers of potentially significant residual effects are predicted.

2.6.48 Options B and C were not adopted in the Proposed Scheme due to the increased effects on views resulting from the loss of larger areas of mature trees and vegetation associated with the RPG, increased effects associated with the introduction of a portal structure into views, the permanent loss of a larger section of a designated section of the curtilage wall compared with Option A and increased cost.

2.6.49 Option A will result in some residual impacts including landscape and visual impacts on Hartwell House and the Grade II* RPG. This option will also result in the permanent loss of part of the listed curtilage of the RPG and demolition of the Grade II listed Glebe House. Further mitigation landscaping and heightened noise fence barriers will reduce impacts within the RPG and from residential receptors on the fringes of Aylesbury.

2.6.50 Option A was considered to provide the best overall outcome and for these reasons together with costs, it was adopted in the Proposed Scheme.

A418 Oxford Road, Aylesbury

2.6.51 The Proposed Scheme will cross the A418 Oxford Road west of Aylesbury and includes a realignment of the A418 approximately 140m to the south of the existing road. The January 2012 announced route included a reinstatement of the A418 on its existing alignment. In the draft ES a diverted alignment was presented following an initial option evaluation. Since the draft ES a further two options have been considered. This two-stage process is described below.

2.6.52 Six options were initially evaluated and presented in the draft ES:

- Option A: The January 2012 announced scheme, comprising an online reinstatement of the A418 Oxford Road along existing highway alignment;
- Option B: An online reinstatement of the A418 Oxford Road along existing alignment with retaining wall to reduce the need for earthworks;
- Option C: An offline reinstatement to the north of the existing highway through Hartwell House RPG;
- Option D: An offline reinstatement approximately 100m to the south of the existing A418 Oxford Road;
- Option E: The scheme presented in the draft ES, an offline reinstatement approximately 250-300m south of existing A418 Oxford Road; and
- Option F: The permanent closure of the A418 and a diversion via alternative routes 5.3km to the north at the A41 Bicester Road and 3.6km to the south at Marsh Lane.

2.6.53 Option A would result in the demolition of the properties adjacent to the existing A418 Oxford Road and to the entire listed curtilage wall along the boundary of the Hartwell House RPG. Option B would reduce these impacts through implementation of a retaining wall. However, both Options A and B would create significant disruption to existing road traffic with temporary road diversions in place. For engineering purposes they were not favoured as they would have been more costly and would have permanently affected access to the adjacent properties. For these reasons Options A and B were not adopted in the Proposed Scheme.

2.6.54 Compared with Options A and B, Option C would result in major adverse impacts on the landscape character of the Hartwell House RPG because the proposed diversion of the A418 Oxford Road of Option C would have run directly through the park. For this reason, Option C was not adopted in the Proposed Scheme.

2.6.55 Option D would have resulted in the demolition of an additional four properties along the existing A418 Oxford Road, in comparison to Option E. Option E would still result in the demolition of one commercial building and it would also result in an impact on the gardens of the properties along the existing A418 Oxford Road. As Option D involves demolition of additional properties, it was not included in the Proposed Scheme.

2.6.56 Option F would have resulted in additional traffic on existing trunk roads and long diversions for traffic. This was not considered viable and for this reason Option F was not adopted in the Proposed Scheme.

2.6.57 Although the residents of Sedrup have expressed concerns about this alignment, the alignment adopted in Option E is considered to be the most environmentally sensitive option and would be consistent with the suggestions put forward by the National Trust for this location.

2.6.58 Further discussions between HS2 Ltd and the proprietors of the Hartwell Depot, the commercial property on the A418 Oxford Road, led to a further option being investigated to avoid demolition of this business premises.

2.6.59 Two options have been evaluated since the draft ES:

- Option A: This was Option E in the initial evaluation, comprising an offline reinstatement approximately 250-300m south of the existing A418 Oxford Road; and
- Option B: The Proposed Scheme, comprising an offline reinstatement approximately 150m south of existing A418 Oxford Road that avoids demolition of the Hartwell Depot.

2.6.60 Both options are very similar in design and hence both have similar impacts as discussed above.

2.6.61 Option B was considered to provide the best overall outcome based on the overriding factor that a commercial building will no longer be demolished and the viability of this property as a business will be retained. It is for this reason that Option B was adopted in the Proposed Scheme.

Replacement of viaduct at Sedrup with embankment and culvert

2.6.62 The Proposed Scheme passes between Aylesbury and Sedrup and through this section it would be on low embankment with culverts to allow water to pass beneath the route.

2.6.63 This was a change from the January 2012 announced scheme, which had proposed low viaducts for crossing the floodplain.

2.6.64 Two options were evaluated:

- Option A: The January 2012 announced scheme, with a low viaduct to cross the floodplain; and
- Option B: The Proposed Scheme, comprising embankments with culverts to allow gravitational flow of watercourses across the Proposed Scheme.

2.6.65 Option A would cross the floodplain on viaduct with sufficient headroom clearance over the watercourse so as to provide certainty that there would be no increase in flood risk. However, the viaduct would be costly, would require higher clearance above the watercourse resulting in a raised alignment and increasing visual impact in this low-lying area.

2.6.66 Option B will not be as costly as Option A and will be less visually intrusive. For these reasons Option B has been adopted in the Proposed Scheme. Option B, the Proposed Scheme, has been designed to ensure that the culverts convey the 1 in 100 year flow including an allowance for climate change. Mitigation measures to address any impact on upstream flood levels have been assumed and discussed with the Environment Agency and are assessed in the EIA.

Replacement of viaduct at Lower Hartwell with embankment and culvert

2.6.67 The Proposed Scheme passes between Aylesbury and Lower Hartwell and through this section it will be on low embankment with culverts to allow water to pass beneath the route.

2.6.68 This was a change from the January 2012 announced scheme, which had proposed low viaducts for crossing the floodplain.

2.6.69 Two options were evaluated:

- Option A: The January 2012 announced scheme, comprising a low viaduct to cross the floodplain; and
- Option B: The Proposed Scheme comprising embankments with culverts to allow gravitational flow of watercourses across the Proposed Scheme.

2.6.70 Option A would cross the floodplain on viaduct with sufficient headroom clearance over the watercourse so as to provide certainty that there would be no increase in flood risk. However, the viaduct would be costly, would require higher clearance above the watercourse resulting in a raised alignment and increasing visual impact in this low-lying area.

2.6.71 Option B will not be as costly as Option A and will be less visually intrusive. For these reasons Option B has been adopted in the Proposed Scheme. Option B, the Proposed Scheme, has been designed to ensure that the culverts convey the 1 in 100 year flow including an allowance for climate change. Mitigation measures to address any impact on upstream flood levels have been assumed and discussed with the Environment Agency and are assessed in the EIA.

Princes Risborough to Aylesbury Line realignment

2.6.72 Where the Proposed Scheme crosses the Princes Risborough to Aylesbury Line, it will pass underneath the existing Network Rail line in shallow cutting. An overbridge will be needed, to raise the Princes Risborough to Aylesbury Line over the route. The Proposed Scheme will include an offline construction of the replacement Princes Risborough to Aylesbury Line.

2.6.73 This is a change from the January 2012 announced scheme, which included an online reinstatement of the Princes Risborough to Aylesbury Line.

2.6.74 The following alternatives were considered:

- Option A: The January 2012 announced scheme, which would include the online reinstatement of the Princes Risborough to Aylesbury Line; and

- Option B: The Proposed Scheme, an offline reinstatement of the Princes Risborough to Aylesbury Line.

2.6.75 The Proposed Scheme (Option B) will result in a very slightly greater loss of Grade 3 agricultural land compared to Option A, because it will increase the footprint of the project.

2.6.76 However, Option A would require a temporary closure of the Princes Risborough to Aylesbury Line during construction which will not be required for the Proposed Scheme. The effect of this would be the cancellation of train services on this part of the railway resulting in considerable adverse transport and community effects.

2.6.77 For these reasons Option B has been adopted in the Proposed Scheme.

Alignment in the vicinity of Fleet Marston

2.6.78 North of Aylesbury towards Fleet Marston the Proposed Scheme will be on low embankment. The vertical alignment of the route between Putlowes Farm and Blackgrove Cottages will be high enough to allow culverts to be installed to aid natural gravitational flow of watercourses across the Proposed Scheme.

2.6.79 The January 2012 announced route was largely at existing ground level through this area, with a realignment of the A41 Bicester Road across the route. An option evaluation was undertaken in order to consider the approach to reducing direct impacts to watercourses in this low-lying and flood prone valley.

2.6.80 Three options were evaluated:

- Option A: The January 2012 alignment, with the provision of pumps to convey water from severed watercourses;
- Option B: The Proposed Scheme, raising the vertical alignment to allow culverts to be installed; and
- Option C: The January 2012 alignment with the provision of drop inlet culverts.

2.6.81 Options A and Option C would have adverse effects on watercourses and floodplain management. They would also require higher levels of maintenance, in particular Option C.

2.6.82 In comparison, Option B would incur slightly greater visual and noise impacts on nearby isolated properties and the landscape character of Waddesdon Manor RPG, although incorporation of landscaping and planting will mitigate these impacts. Option B will have the least impact on the watercourses and the aquatic environment supported by them because it will allow the five water crossings to retain natural gravity-induced flows. It will also require less maintenance and so reduces the whole life cost.

2.6.83 For these reasons Option B has been adopted in the Proposed Scheme.

3 Agriculture, forestry and soil

3.1 Introduction

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

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

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

3.1.4 Soil attributes other than those relating to agricultural and forestry use are identified in this section but assessed in terms of their primary attributes in other sections, notably cultural heritage, ecology and landscape and visual assessment (see Sections 6, 7 and 9).

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

3.1.6 Details of published and publically available information used in the assessment, and the results of surveys undertaken within this area, are contained in Volume 5: Appendix AG-001-011.

3.2 Scope, assumptions and limitations

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

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

3.2.3 Common assumptions that have been applied to the Proposed Scheme, such as the restoration of agricultural land to pre-existing quality, the handing back of land used temporarily to the original landowner and the non-replacement of capital items demolished, are set out in Volume 1. There are no assumptions or limitations that are specific to the assessment in this area.

3.3 Environmental baseline

Existing baseline

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

Soils and land resources

Topography and drainage

3.3.3 The main topographical features are described in detail in the landscape and visual assessment (Section 9). The arterial drainage is provided by the River Thame, which drains roughly north-east to south-west. Land in this area is mostly gently undulating although there are some steeper slopes to the north-west of the section. The altitude rises from the river and its tributaries, at around 80m Above Ordnance Datum (AOD), to the surrounding hills at around 140m AOD.

Geology and soil parent materials

3.3.4 The main geological features are described in the land quality assessment (Section 8). The principal underlying geology mapped in the south of the section is that of the Gault Clay Formation, which consists primarily of mudstone. A band of variable limestone and sandstone marks the mid-section boundary between the Gault Formation and the Kimmeridge Clay, which is prominent in the northern half of the section. Superficial Head deposits of clay, silt, sand and gravel are mapped in the valleys.

Description and distribution of soil types

3.3.5 The characteristics of the soils are described by the Soil Survey of England and Wales[13] and shown on the National Soil Map[14]. Throughout this area they are variable according to the topography and geology and are described in more detail in Volume 5. The distribution is shown on Map AG-02-011 (Volume 5).

3.3.6 The underlying Gault Clay around Stoke Mandeville gives rise to the fine loamy topsoils over clay subsoils of the Grove association, which are calcareous and seasonally waterlogged, typically in Wetness Class[15] (WC) III, but they can be improved with drainage to WC II.

3.3.7 In the middle section over the sloping and highest lying ground are Evesham 2 and Aberford soils. Evesham 2 soils are generally calcareous, medium and heavy clay loams but have local variations in depth and drainage depending upon the parent material, which consists of Jurassic clay and limestone bands. With under-drainage, Evesham 2 soils are typically of WC II or III. Aberford soils are well drained (WC I), with fine loamy topsoils and calcareous clay soils over limestone with variable stone content. Aberford soils are dominant on the hill tops.

3.3.8 There are Fladbury 1 soils on the floodplain of the River Thame to the west of Aylesbury. These have heavy clay loam topsoils over clay and they are poorly drained, most commonly of WC IV.

3.3.9 In the central and northern section extensive areas of the Denchworth association are mapped. These soils are developed over the heavy Kimmeridge and Gault clays and they have fine loamy topsoils over clayey subsoils, are poorly drained and of WC IV.

Soil and land use interactions

Agricultural land quality

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

3.3.11 The main soil properties that affect the cropping potential and management requirements of land are texture, structure, depth, stoniness and chemical fertility. Together they influence the functions of soil and affect water availability for crops, drainage and workability; with agricultural land quality mainly determined by soil workability and/or droughtiness limitations.

[13] Soil Survey of England and Wales (1984), *Soils and Their Use in South East England*: Harpenden.
[14] Cranfield University (2001), *The National Soil Map of England and Wales* 1:250,000 scale.
[15] The Wetness Class of a soil is classified according to the depth and duration of waterlogging in the soil profile and has six bands.

3.3.12 Climate in this area does not in itself place any limitation upon land quality but the interactions of climate with soil characteristics are important in determining the wetness and droughtiness limitations of land. The local agro-climatic data have been interpolated from the Meteorological Office's standard 5km grid point data set for three points within this area and are set out in Volume 5: Appendices, AG-001-011. The data show average temperatures to be moderately warm and average annual rainfall to be moderate to moderately dry. The resulting number of Field Capacity Days is shorter than the average for lowland England at around 137 days and is favourable for providing opportunities for agricultural field work.

3.3.13 Gradient (slope) and microrelief (landform undulations) are not generally considered limiting in the Stoke Mandeville and Aylesbury area. Flooding is limited to the floodplains of the River Thame through the north-west of this area and its tributaries. A flood risk may result in the downgrading of land to Subgrade 3b or Grade 4 in places.

3.3.14 Field surveys have identified that the soils of the Grove association around Stoke Mandeville have fine loamy topsoils and are graded as Subgrade 3a due to soil workability.

3.3.15 Calcareous Evesham 2 soils of WC II or III are graded as Subgrade 3a in this area, with a workability limitation due to the heavy clay loam topsoil.

3.3.16 The well drained Aberford soils are limited by soil workability depending upon the specific clay content of the topsoil; medium clay loam soils give rise to Grade 2 and heavy clay loams to Subgrade 3a. However, droughtiness is also likely to be a significant limitation in this area due to increasing stoniness with depth, and limits the land to Grade 2 or 3a on droughtiness.

3.3.17 To the north and west of the area soils of the Fladbury 1 association are mapped in the floodplain of the River Thame and its tributaries and are clayey and slowly permeable. They are commonly of WC IV that, given the clay loam topsoil, will limit the land to no better than Subgrade 3b under the climatic conditions applicable to the Stoke Mandeville and Aylesbury section. The same applies to the soils of the Denchworth association, which have medium to heavy clay loam topsoil textures over clay subsoils. They have slowly permeable subsoils (WC IV), and overlie heavy Kimmeridge and Gault clay geology.

3.3.18 Department for Environment, Food and Rural Affairs (Defra) mapping[16] shows that there is generally a low likelihood of encountering BMV land in the locality, which makes such land a resource of high sensitivity in this area.

Other soil interactions

3.3.19 Soil fulfils a number of functions and services for society in addition to those of food and biomass production which are central to social, economic and environmental sustainability. These are outlined in sources such as the Soil Strategy for England[17] and The Natural Choice: securing the value of nature[18], and include:

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

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

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

3.3.21 The floodplains of the River Thame and its tributaries represent the functional flood environment as set out in Section 13. Flood Zone mapping available from the Environment Agency shows there to be a significant risk of flooding within this area.

3.3.22 The presence of soil-borne cultural assets is detailed in Section 6. In the south the lighter soils to the south of Aylesbury are well suited to ploughing, agriculture and settlement, and Bronze Age and Iron Age remains have been recorded indicative of a landscape of small farmsteads.

Land use description

3.3.23 Agricultural land use is predominantly arable, within large fields, interspersed with significant areas of grassland. The land to the south of Stoke Mandeville has a patchwork of small pasture fields used to graze livestock and horses whilst the land to the west of Aylesbury has a large area of grassland associated with the dairy unit at Calley Farm. There is also grassland to the north of Lower Hartwell associated with beef units in the area.

3.3.24 A number of environmental designations potentially influence land use within the study area. The whole area is a nitrate vulnerable zone (NVZ), which is an area in which nitrate pollution is a potential problem. Statutory land management measures apply which seek to reduce nitrogen losses from agricultural sources to water. Some agricultural land is also subject to management prescriptions associated with the Environmental Stewardship Scheme which seeks either generally (the Entry Level Scheme - ELS) or specifically (the Higher Level Scheme - HLS) to retain and enhance the landscape and biodiversity qualities and features of farm land. Holdings which have land entered into an agri-environment scheme are identified in Table 4.

3.3.25 Forest cover within the area (at 3% of land use) is less than the national average (10%). Almost all of the woodland within the area is within the grounds of Hartwell House, with other smaller woodland consisting of field shelter belts and the small copse at the former site of the church of St Mary.

Number, type and size of farms

3.3.26 There is a mixture of owner-occupation and tenancies rented from various landowners, under both long and short-term tenancy agreements. Land which is owner-occupied is mainly restricted to Marsh Hill, Moat and Fleet Marston Farms. The boundaries of the holdings are shown on Maps AG-01-21b to AG-01-025 (Volume 5) along with the location of the main farm buildings. Field drainage is common on the eastern side of the study area, but no farms have been identified that undertake routine field irrigation of crops.

3.3.27 Table 4 sets out the sensitivity of individual holdings to change, which is determined by the extent to which they have the capacity to absorb or adapt to impacts, which in turn is determined primarily by their nature and scale. In general terms, larger holdings have a greater capacity to change enterprise mix and scale, can absorb impacts better and are less sensitive. Units that rely on the use of buildings (such as intensive livestock and dairy farms, and horticultural units) are less able to accommodate change and have a higher sensitivity. Smaller (less intensively used) units, such as pony paddocks associated with residential properties, have a low sensitivity. The holding/reference name provides a unique identifier and relates to Maps AG-01-021b to AG-01-025a (Volume 5, Agriculture, forestry and Soils Map Book) and Volume 5: Appendix AG-001-011.

Table 4: Summary of characteristics of holdings

Holding reference/name	Holding type	Holding size (Ha)	Diversification	Agri-environment	Sensitivity to change
CFA11/1 Stoke House	Arable and grassland for equestrian yard	93	None identified	ELS	Medium
CFA11/2 Windrush House, Terrick	All land let to others for arable and grazing	104	None identified	None	Low
CFA11/3 * Mill House Farm	Free range poultry	3	None identified	None	Medium
CFA11/4 Marsh Mill Farm	Arable, beef cattle, sheep	194	Rural training centre at farm	ELS	Medium
CFA11/5 Whitethorn Farm	Grassland for grazing, some let	8	Dog kennels and training centre under development	None	Low
CFA11/6 Moat Farm	Arable, beef cattle, sheep	360	Christmas turkeys, planning permission to convert buildings into offices	ELS	Medium
CFA11/7 Standall's Farm	Arable and beef cattle	263	Catering	ELS	Medium

CFA11/8 Calley Farm	Dairy and arable	283	None identified	ELS	High
CFA11/9 Lower Hartwell Farm and Whaddon Hill Farm	Arable and beef cattle	283	Small shoot	ELS and HLS	Medium
CFA11/10 Putlowes Farm	Arable and beef cattle	156	None identified	ELS and HLS	Medium
CFA11/11 Fleet Marston Farm	Arable	185	Buildings let and farm shop	None	Medium
CFA11/12 * Bucks Goat Centre	Goats	1	Animal visitor attraction	None	High
CFA11/13 * Red House Farm	Grazing	42	None identified	ELS	Medium

* No Farm Impact Assessment interview

Future baseline

Construction (2017)

3.3.28 The Berryfields Major Development Area (MDA) is a 195ha site to the west of Aylesbury that will affect approximately 177ha of agricultural land, of which 25ha is BMV. None of the holdings affected by the Proposed Scheme will lose land to the Berryfields development.

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

Operation (2026)

3.3.30 No further committed developments have been identified in this local area that will materially alter the baseline conditions in 2026 for agriculture, forestry and soils.

3.4 Effects arising during construction

Avoidance and mitigation measures

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

- replacement field accesses associated with the new Stoke Mandeville bypass;
- agricultural accommodation bridge associated with Stoke House (CFA11/1) over the bypass;
- agricultural accommodation bridge at Calley Farm (CFA11/8) and Putlowes Farm (CFA11/10);
- agricultural accommodation bridge incorporated into footpath crossings at Standall's Farm (CFA11/7);
- agricultural access under the Thame viaduct; and
- improvement to cattle handling areas and new crossings on the Aylesbury to Princes Risborough Line to provide access to severed land associated with Moat Farm (CFA11/6).

3.4.2 In addition, there is a need to avoid or reduce environmental impacts to soils during construction. It is an essential element of the construction process that the soil resources from the areas required temporarily and permanently are stripped and stored so that land required temporarily for construction purposes which is currently in agricultural use can be returned to that use, where agreed, and to its pre-existing agricultural condition.

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

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

- the reinstatement of agricultural land which is used temporarily during construction to agriculture, where this is the agreed end use (draft CoCP: Section 6);
- the provision of a method statement for stripping, handling, storing and replacing agricultural and woodland soils to reduce risks associated with soil degradation on areas of land to be returned to agriculture and woodland following construction, based on detailed soil survey work to be undertaken prior to construction. This will include any remediation measures necessary following the completion of works (draft CoCP, Section 6);

- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect agriculture, forestry and soil resources during construction (draft CoCP, Section 5);
- arrangements for the maintenance of farm and field accesses affected by construction (draft CoCP, Section 6);
- the protection and maintenance of existing land drainage and livestock water supply systems, where reasonably practicable (draft CoCP, Sections 6 and 16);
- the protection of agricultural land adjacent to the construction site, including the provision and maintenance of appropriate stock-proof fencing (draft CoCP, Sections 6 and 9);
- the adoption of measures to control the deposition of dust on adjacent agricultural crops (draft CoCP, Section 7);
- the control of invasive and non-native species; and the prevention of the spread of weeds generally from the construction site to adjacent agricultural land (draft CoCP, Section 9);
- the adoption of measures to prevent, as far as reasonably practicable, the spread of soil-borne, crop and animal diseases from the construction area (draft CoCP, Sections 6 and 9); and
- liaison and advisory arrangements with affected landowners, occupiers and agents, as appropriate(draft CoCP, Sections 5 and 6).

Assessment of impacts and effects

3.4.5 The cessation of existing land uses will be required in the area to construct and operate the Proposed Scheme. This includes not only the land on which permanent works will be sited, but also that required temporarily to facilitate the delivery of those permanent works.

3.4.6 All of the land required to implement the Proposed Scheme will, therefore, be affected during the construction phase. The land required for the construction and operation of the Proposed Scheme will, in places, sever and fragment individual fields and operational units of agricultural and forestry land. This will result in potential effects associated with the ability of affected agricultural interests to continue to access and effectively use residual parcels of land. There may also be the loss of, or disruption to, buildings and operational infrastructure such as drainage. The scheme design seeks, however, to minimise this structural disruption where reasonably practicable, and to incorporate inaccessible severed land as part of environmental mitigation works.

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

Temporary effects during construction

Impacts on agricultural land

3.4.8 During the construction phase, the total area of agricultural land used will be 308.9ha as shown in Table 5. Of this total, 100.7ha will be restored and available for agricultural use following construction.

Table 5: Agricultural land required temporarily within study area

Agriculture land quality	Area required (ha)	Percentage of agricultural land	Area to be restored (ha)
Grade 1	0	0	0
Grade 2	0	0	0
Subgrade 3a	137.2	44	51.6
BMV subtotal	137.2	44	51.6
Subgrade 3b	171.7	56	49.1
Grade 4	0	0	0
Grade 5	0	0	0
Total agricultural land	308.9		100.7

3.4.9 The disturbance during construction to 137.2ha of land of BMV quality is assessed as an impact of medium magnitude, comprising between 20% and 60% of the agricultural land requirement. However, as BMV land in this local area is a receptor of high sensitivity, the effect on BMV land is assessed as a major/moderate adverse effect of the Proposed Scheme, which is significant.

3.4.10 Following construction the land required temporarily will be primarily reinstated to its pre-existing agricultural condition. It is estimated that there will not be any significant surplus of topsoil or subsoil material arising from the Proposed Scheme in the area.

Nature of the soil to be disturbed

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

3.4.12 Successful soil handling is dependent upon movements being undertaken under appropriate weather and ground conditions using the appropriate equipment. The principles of soil handling are well established and set out in advisory material such as Defra's Code of Practice for the Sustainable Use of Soils[19]. This guidance will be followed throughout the construction period, particularly for the heavier Denchworth and Fladbury 1 soils which are more 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.

3.4.13 Compliance with the CoCP will ensure that the magnitude of impact on soil is low and that the significance of effect is negligible.

Impacts on holdings

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

3.4.15 The effects of the Proposed Scheme on individual agricultural and related interests during the construction period are summarised in Table 6. This table shows the total area of land required on a particular holding in absolute terms and as a percentage of the total area farmed. It also shows the area of land that will be returned to the holding following the construction period. The scale of effect is based on the proportion of the holding required rather than the absolute area of land. The holding/reference name provides a unique identifier and relates to Maps AG-01-021b to AG-01-25a (Volume 5, Agriculture, Forestry and Soils Map Book) and Volume 5: Appendix AG-001-011.

3.4.16 The effects of severance during construction are judged on the ease and availability of access to severed land. For the most part these will be same during and post construction but occasionally they will differ between the two phases. The disruptive effects, principally of construction noise and dust, are assessed according to their effects on land uses and enterprises. Full details of the nature and significance of effects are set out in Volume 5: Appendix AG-001-011. Where the total sum of the land required by ALC grade differs from the total sum of the land required by holding, the difference is because some holdings are affected in more than one CFA and some holdings include non-agricultural land. The combined impact on holdings is reported once in the area where the main holding is located.

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

Table 6: Summary of temporary effects on holdings from construction

Holding reference/name	Total area required	Construction Severance	Disruptive effects	Scale of construction effect	Area to be restored
CFA11/1 Stoke House	22.2ha (24%) High	Holding severed by the A4010 Stoke Mandeville bypass; structure provided. Low	Negligible	Major/moderate adverse due to the proportion of the holding required and severance	9.2ha
CFA11/2 Windrush House, Terrick	11.8ha (11%) Medium	Negligible	Negligible	Minor adverse	5.7ha
CFA11/3 Mill House Farm	0.9ha (29%) High	Negligible	Negligible	Major/moderate adverse due to the proportion of the holding required	0.3ha
CFA11/4 Marsh Mill Farm	6.2ha (3%) Negligible	Land severed by Proposed Scheme and the A4010 Stoke Mandeville bypass accessible from public highway. Downgraded as already severed. Low	Negligible	Minor adverse	2.9ha
CFA11/5 Whitethorn Farm	4.7ha (57%) High	Holding severed no access provided. High impact	Negligible	Moderate adverse due to proportion of the holding required and severance.	2.5ha
CFA11/6 Moat Farm	70.2ha (20%) High	Holding severed by Proposed Scheme and the A4010 Stoke Mandeville bypass; limited access available. Medium	Negligible	Major/moderate adverse due to proportion of the holding required and severance.	20.5ha
CFA11/7 Standall's Farm	17.9ha (7%) Low	Partial severance during utility diversion works. Low	Negligible	Minor adverse	9.1ha
CFA11/8 Calley Farm	103.7ha (37%) High	Partial severance during utility diversion works.	Negligible	Major adverse due to proportion of the holding required	20.9ha

Holding reference/name	Total area required	Construction Severance	Disruptive effects	Scale of construction effect	Area to be restored
		Low			
CFA11/9 Lower Hartwell Farm and Whaddon Hill Farm	25.4ha (9%) Low	Small area severed north of the Thame Valley viaduct. Low	Negligible	Minor adverse	10.1ha
CFA11/10 Putlowes Farm	28.6ha (18%) Medium	Farm severed, accommodation structure provided. Low	Negligible	Moderate adverse due to proportion of the holding required and severance	10.7ha
CFA11/11 Fleet Marston Farm	15.9ha (9%) Low	Small area of land severed by the Proposed Scheme to be acquired for mitigation. Negligible	Negligible	Minor adverse	9.5ha
CFA11/12 Bucks Goat Centre	< 0.1ha (3%) Negligible	Negligible	Negligible	Minor adverse	< 0.1ha
CFA11/13 Red House Farm	0.3ha (1%) Negligible	Negligible	Negligible	Negligible	0ha

3.4.17 Overall, it is considered that six holdings will experience major or moderate adverse effects during the construction phase, which are significant.

3.4.18 No farm enterprises that are particularly sensitive to noise or vibration emitted during the construction phase, for example intensive poultry houses, have been identified near the Proposed Scheme.

Cumulative effects

3.4.19 The Berryfields MDA will involve the loss of agricultural land. However, this will be a permanent impact and does not provide any cumulative temporary effects on agricultural land or holdings.

Permanent effects from construction

Impacts on agricultural and forestry land

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

- part of the operational railway and kept under the control of the operator;
- returned to agricultural use (with restoration management);

- used for drainage or flood compensation which may also retain some agricultural use; or
- used for ecological and landscape mitigation.

3.4.21 Following construction and restoration, the area of agricultural land that will be permanently required will be 208.2ha, as shown in Table 7.

Table 7: Agricultural and forestry land required permanently

Agricultural land quality	Total area required (ha)	Percentage of agricultural land
Grade 1	0	0
Grade 2	0	0
Subgrade 3a	85.6	41
BMV subtotal	85.6	41
Subgrade 3b	122.6	59
Grade 4	0	0
Grade 5	0	0
Total	208.2	
Non-agricultural forestry land	4.5	

3.4.22 The permanent loss of 85.6ha of land of BMV quality is assessed as an impact of medium magnitude, comprising between 20% and 60% of the agricultural land requirement. As stated previously, BMV land in this area is a receptor of high sensitivity so that the permanent effect on BMV land is assessed as a major/moderate adverse effect of the Proposed Scheme, which is significant.

3.4.23 The total area of forestry land required to implement the Proposed Scheme is 4.5ha out of a total land requirement of 425.4ha (1%) and is an impact of low magnitude. However, as forestry is assessed as having a high sensitivity to change in this area the quantitative effect is assessed as moderate adverse, and is significant. Insofar as forestry land may have some non-commercial value, for example in ecological or landscape terms, the qualitative assessment of this loss is addressed in the relevant sections.

3.4.24 Some areas of agricultural land that are required for the construction of the Proposed Scheme will revert to land for ecological and landscape mitigation and will be removed from mainstream agricultural production. These areas include land between the Proposed Scheme and Aylesbury, from the Princes Risborough to Aylesbury Line to the northern end of Aylesbury Park Golf Club. For the purposes of this agricultural assessment it is assumed that none of this land will return to agriculture and it has been included in the figures above.

3.4.25 In total some 16ha of agricultural land will be engineered to provide additional flood compensation capacity and could be subject to marginal downgrading in agricultural land quality. For this assessment it is assumed that this land will return to agriculture and will assume the same ALC.

Impacts on holdings

3.4.26 The permanent residual effects from the construction of the Proposed Scheme on individual agricultural and related interests is summarised in Table 8. The land required column refers to the area of land permanently required to operate the Proposed Scheme (in absolute terms and as a percentage of the overall area farmed). The scale of effect is based on the proportion of land required. The effects of severance are judged on the ease and availability of access to severed land once construction is completed. The impact on farm infrastructure refers mainly to the loss of or damage to farm capital, such as property, buildings and structures, and the consequential effects on land uses and enterprises. Full details of the nature and scale of effects are set out in Volume 5: Appendix AG-001-011, Section 4.

Table 8: Summary of permanent effects on holdings from construction

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
CFA11/1 Stoke House	13.0ha (14%) Medium	Holding severed by the A4010 Stoke Mandeville bypass; structure provided. Low	Negligible	Moderate adverse due to proportion of holding permanently required and severance.
CFA11/2 Windrush House, Terrick	6.2ha (6%) Low	Negligible	Negligible	Negligible
CFA11/3 Mill House Farm	0.6ha (18%) Medium	Negligible	Negligible	Moderate adverse due to the proportion of the holding required
CFA11/4 Marsh Mill Farm and Yew Tree Farm	3.3ha (2%) Negligible	Land severed by Proposed Scheme and the A4010 Stoke Mandeville bypass accessible from public highway. Downgraded as already severed. Low	Negligible	Minor adverse
CFA11/5 Whitethorn Farm	2.3ha (27%) High	Holding severed no access provided. High impact	Agricultural buildings demolished High	Moderate adverse due to building demolition and the proportion of the holding required but low sensitivity
CFA11/6	49.7ha (14%)	Holding severed by Proposed Scheme	Negligible	Moderate adverse due to proportion of

Holding reference/name	Land required	Severance	Infrastructure	Scale of effect
Moat Farm	Medium	and the A4010 Stoke Mandeville bypass; limited access available. Medium impact.		the holding required and severance
CFA11/7 Standall's Farm	8.8ha (3%) Negligible	Negligible	Negligible	Negligible
CFA11/8 Calley Farm	82.8ha (29%) High	Negligible	Negligible	Major adverse due to proportion of the holding required and high sensitivity of the holding
CFA11/9 Lower Hartwell Farm and Whaddon Hill Farm	15.3ha (5%) Low	Land severed but accessible under the Thame Valley viaduct Negligible	Negligible	Minor adverse
CFA11/10 Putlowes Farm	17.9ha (11%) Medium	Holding severed, accommodation structure provided Low	Negligible	Moderate adverse due to proportion of the holding required and severance
CFA11/11 Fleet Marston Farm	6.3ha (3%) Negligible	Negligible	Negligible	Negligible
CFA11/12 Bucks Goat Centre	< 0.1ha (1%) Negligible	Negligible	Negligible	Minor adverse
CFA11/13 Red House Farm	0.3ha (1%) Negligible	Negligible	Negligible	Negligible

3.4.27 Overall, it is likely that six holdings will experience major or moderate permanent adverse effects from the construction of the Proposed Scheme, which are significant. Calley Farm, which is presently farmed by an agricultural tenant with dairy cattle, will lose approximately 40% of the holding during construction and only 11% will be restored. It seems unlikely that Calley Farm will continue to function with dairy cattle and an alternative agricultural use for the holding will be required.

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

Cumulative effects

3.4.29 Developments associated with the Berryfields MDA will result in the loss of 177ha of agricultural land, of which 25.0ha is BMV. The Proposed Scheme will require the permanent loss of 208.2ha of agricultural land, of which 85.6ha is BMV. The cumulative impact of these developments in this area will be the loss of 385.2ha of agricultural land, of which 110.6ha is BMV; this remains a significant effect.

Other mitigation measures

3.4.30 Other mitigation measures that are proposed include woodland planting. Where appropriate, soils from the ancient and other woodland areas that would be removed during construction of the Proposed Scheme would be utilised in this process, as discussed in Section 7. Mitigation will incorporate climate change adaptation and resilience measures, as far as practicable.

Summary of likely significant residual effects

3.4.31 Once the construction process is complete and land required temporarily has been restored, the residual permanent loss of agricultural land will be 208.2ha, of which 85.6ha is BMV. This is assessed as a major/moderate adverse residual effect, which is significant.

3.4.32 A total of six holdings have been identified that will experience major or moderate permanent effects, which is significant. Of these five will be likely to remain as agricultural or rural businesses and the use of compensation payments to purchase replacement land or farm buildings could reduce the effects. Whitethorn Farm (CFA11/5) will cease as an agricultural holding due to property demolition and loss of land.

3.5 Effects arising from operation

Avoidance and mitigation measures

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

Assessment of impacts and effects

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

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

3.5.3 The potential for significant effects on sensitive livestock receptors from noise has been assessed. No likely significant effects have been identified. The horses at Stoke House lie some 270m from the Proposed Scheme; Bucks Goat Centre is some 170m distant and Hartwell Riding Stables are over 700m distant.

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

Summary of likely significant residual effects

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

4 Air quality

4.1 Introduction

4.1.1 This section of the report provides an assessment of the impacts and likely significant effects on air quality arising from the construction and operation of the Proposed Scheme, covering nitrogen dioxide (NO_2), fine particulate matter (PM_{10} and $PM_{2.5}$)[20] and dust.

4.1.2 With regard to air quality, the main potential effects are anticipated to result from the emissions of the pollutants from road traffic, construction activities and equipment, demolition, site preparation works, and the use of haul routes within the sites.

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

- Appendix AQ-001-011;
- Map AQ-01-11; and
- Map AQ-02-11-01 and 02 (Volume 5, Air Quality Map Book).

4.1.4 Maps showing the location of the key environmental features are shown on Map Series CT-10 (Volume 2, CFA11 Map Books).

4.2 Scope, assumptions and limitations

4.2.1 The assessment scope, key assumptions and limitations for the air quality assessment are set out in Volume 1, the SMR (Appendix CT-001-000/1), the SMR Addendum (Appendix CT-001-000/2) and appendices presented in Volume 5: Appendix AQ-001-004. This report follows the standard assessment methodology.

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

4.2.3 The assessment of impacts arising from construction dust emissions has been undertaken using the methodology based on that produced by the Institute of Air Quality Management (IAQM)[21]. It is important to note that this methodology provides a means of assessing the scale and significance of effects that is partly dependent on the approximate number of receptors within close proximity to the dust-generating activities. In doing so, it assigns a lower scale of effect to cases where the number of properties is small, e.g. fewer than 10 properties within 20m of dust-generating activities. Thus, a single property very close to a construction site cannot experience a 'significant effect' as defined by this methodology. The assessment presented here reaches a conclusion that incorporates this concept of significance being proportional

[20] $PM_{2.5}$ and PM_{10} describe two size fractions of airborne particles that can be inhaled and therefore are of concern for human health. The designations refer to particles of size less than 2.5 and 10 microns in diameter.
[21] IAQM (2011), *Guidance on the assessment of the impacts of construction on air quality and the determination of their significance.*

to the number of people affected. However, in cases where less than 10 properties are within 20m of the construction activity, it will still be the case that mitigation in accordance with the CoCP will be applied.

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

4.3 Environmental baseline

Existing baseline

4.3.1 The environmental baseline reported in this section represents the environmental conditions identified within the study area. The air quality within the Stoke Mandeville and Aylesbury area is typical of the generally rural nature of this part of Buckinghamshire, with concentrations of airborne pollutants well within air quality standards. There are few roads and low road traffic flows (with their associated emissions) giving rise to low concentrations of airborne pollutants.

4.3.2 Estimates of background air quality have been obtained from the Department for Environment, Food and Rural Affairs (Defra) background maps[22] for 2012. These data are estimated for 1km grid squares for nitrogen oxides (NOx), NO2, PM10 and PM2.5. All average background pollutant concentrations are well within relevant air quality standards[23].

4.3.3 Aylesbury Vale District Council currently conducts routine monitoring using diffusion tubes and continuous monitors. However, almost all of these monitoring locations are at roadside locations and in the towns in locations that are away from the Proposed Scheme and are not affected by scheme related traffic. There are, however, a number of monitoring locations within Aylesbury that are relevant to the assessment as they are locations where construction traffic is predicted to be present.

4.3.4 Three air quality management areas (AQMAs) have been declared by Aylesbury Vale District Council. All three AQMAs are located in the town of Aylesbury and all declared because of potential exceedances of the NO2 annual mean objectives. Of these, the Friarage Road/Oxford Road AQMA covers an area that has been identified as a proposed haulage route to be taken by traffic during the construction phase and therefore further consideration of this has been undertaken.

[22] Defra (2010), *Based Background Maps for NOx, NO2, PM10 and PM2.5*; http://laqm.defra.gov.uk/maps/maps2010.html; Accessed July 2013.
[23] Long-term concentrations are usually described by the annual average concentration. Short-term concentrations refer to those which are measured as daily or hourly averages and for which standards refer to peak concentrations, usually captured as a percentile concentration. For a site with high data capture, the short-term standard for NO2 is equivalent to the 99.78th percentile of hourly concentrations in a year.

4.3.5 The available mapping data indicate that, in all parts of the study area, concentrations of PM10 and PM2.5 meet air quality standards, as supported by the absence of any AQMAs declared for these pollutants.

4.3.6 Potential receptors are primarily those residential properties close to proposed construction activity and alongside roads where traffic flows will change as a consequence of construction activity or realignment of roads. Notable receptors in close proximity to construction activity are residential properties on Old Risborough Road, Whitethorn Farmhouse, Park Villa, Putlowes, Fleet Marston Cottages, Long Acre and properties on Meadoway. Receptors at greatest risk of dust effects are indicated in Map AQ-02-11-01 and 02.

4.3.7 Construction traffic using the A41 Bicester Road and A418 Oxford Road through Aylesbury has the potential to affect air quality for receptors along these roads and the presence of the AQMAs in Aylesbury is a consideration. Three receptors have been considered in relation to traffic emissions when the Proposed Scheme is operational as a consequence of road re-alignments, in particular the Oaks/Hartwell Cottages, Hatters End and Hall End.

4.3.8 The western tip of Chilterns Beechwoods Special Area of Conservation (SAC) has been identified as an ecological receptor that could be affected by the emissions from construction traffic using the A41010.

Future baseline

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

Construction (2017)

4.3.10 Future background pollutant concentrations have been sourced from Defra background maps22 for 2017, which predict NO_2 and PM10 levels in 2017 to be lower than in the 2012 baseline.

Operation (2026)

4.3.11 Future background pollutant concentrations have been sourced from Defra background maps22 for 2026, which predict NO_2 and PM10 levels in 2026 to be lower than in the 2012 baseline.

4.4 Effects arising during construction

Avoidance and mitigation measures

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

4.4.2 The assessment has assumed that the general measures detailed in Section 7 of the draft CoCP (Volume 5: Appendix CT-003-000/1) will be implemented. These include:

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

Assessment of impacts and effects

Temporary effects

4.4.3 Impacts from the construction of the Proposed Scheme could arise from dust-generating activities, emissions from construction traffic, or temporary road realignment. As such, the assessment of construction impacts has been undertaken for human receptors sensitive to dust and exposure to NO_2 and PM_{10}, as well as ecological receptors sensitive to nitrogen deposition.

4.4.4 An assessment of construction traffic emissions has also been undertaken for two scenarios in the construction period: a without the Proposed Scheme scenario and a with the Proposed Scheme scenario. The traffic data include the additional traffic from future committed developments.

4.4.5 In the Aylesbury Vale area, demolition and construction sites at and around the route will have the potential to give rise to dust emissions. In particular, the construction of cuttings and embankments, the Thame Valley viaduct and the A4010 Stoke Mandeville bypass will be areas where dust emissions could arise, together with the use of vehicles to remove excavated material on the haul route along the alignment. Given the implementation of mitigation measures, including the use of LEMPs for receptors close to the haul route, no significant effects are predicted to arise from dust emissions. The basis for this conclusion, taking into account the proximity of receptors and the magnitude of the emissions, can be found in Volume 5: Appendix AQ-001-011.

4.4.6 Construction traffic will use the A418 Oxford Road and A41 Bicester Road through Aylesbury. As described in Section 4.3, there are AQMAs along these roads in the town centre. The impacts of the construction traffic for receptors along these roads in Aylesbury and in the AQMAs have been quantified and the effects on receptors assessed. The assessment is described fully in Volume 5: Appendix AQ-001-011. The impacts for most receptors along these roads were found to be negligible or slight adverse and not significant. However, there were some receptors along the section of the A41 Gatehouse Road and the A41 Bicester Road on the west side of Aylesbury where moderate adverse impacts were identified. This is a temporary significant effect.

4.4.7 An increase in construction traffic on the A4010 Risborough Road, on the western tip of the Chilterns Beechwoods SAC, has been assessed for its impact on the designated site and is considered not to be significant. The HRA screening report is presented in Volume 5: Appendix EC-010-002.

Permanent effects

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

Cumulative effects

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

Other mitigation measures

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

Summary of likely significant residual effects

4.4.11 The methods outlined within the draft CoCP to control and manage potential air quality effects are considered to be effective in this area and no significant residual effects on air quality from dust emissions are considered likely. Some locations in Aylesbury along the A41 Bicester Road were identified where there will be significant residual effects from road traffic emissions.

4.5 Effects arising from operation

Avoidance and mitigation measures

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

Assessment of impacts and effects

4.5.2 Impacts from the operation of the Proposed Scheme will relate to changes in the volume, composition and distribution of road traffic. There are no direct atmospheric emissions from the operation of trains that will cause an impact on air quality and these have therefore not been assessed.

4.5.3 The assessment of operational traffic emissions has been undertaken for two scenarios in the operation year 2026: a) without the Proposed Scheme scenario and b) with the Proposed Scheme scenario. The traffic data include the additional traffic from future committed developments.

4.5.4 Traffic data in the Aylesbury Vale area have been screened to identify roads that require a more detailed assessment and to confirm the likely effect of the change in emissions from vehicles using those roads in 2026.

4.5.5 Three roads are predicted to have sufficiently large changes in traffic flows to meet the criteria for further assessment. Receptors representative of worst-case exposure locations were selected. These included locations closest to junctions or facing onto the affected roads. The three receptors chosen were: The Oaks/Hartwell Cottage, Hatters End and Hall End. The first of these is predicted to experience a large decrease in concentrations of NO_2 and PM10 and the other two will experience an imperceptible or slight increase in concentrations. In all cases, therefore, the effect will not be significant.

Cumulative effects

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

Other mitigation measures

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

Summary of likely significant residual effects

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

5 Community

5.1 Introduction

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

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

- permanent stopping up of A4010 Risborough Road, Old Risborough Road and Marsh Lane; and
- loss of land at Aylesbury Park Golf Club, due to construction and operation of the Proposed Scheme.

5.1.3 Further details of the community assessments and open space recreational PRoW surveys undertaken within the area are contained in Volume 5: Appendix CM-001-025.

5.1.4 Community assessment maps are provided in Maps CM-01-033b to CM-01-037a (Volume 5, Community Map Book).

5.1.5 The current assessment draws upon information gathered from local and regional sources including: Buckinghamshire County Council; Aylesbury Park Golf Club; Stoke Mandeville Combined School; Weston Turville Golf Club; Aylesbury Golf Centre; Bucks Goat Centre; and Kimble Parish Council.

5.2 Scope, assumptions and limitations

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

5.2.2 Construction worker accommodation will be located at the A41 Bicester Road embankment main compound, north-west of Fleet Marston. Construction worker impacts on community resources are considered at a route wide level in Appendix CM-002-000. The assessment takes into account the number of workers, the type and location of accommodation, working hours, facilities provided on construction compounds, experience from other large projects (such as HS1) and the measures contained in the draft CoCP. On this basis it is concluded that there will be no significant effects associated with construction worker accommodation.

5.3 Environmental baseline

Existing baseline

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

5.3.2 The study area includes the area of land required both temporarily and permanently for the construction and operation of the Proposed Scheme, together with a wider corridor within which receptors or resources could be affected by a combination of significant residual effects, such as noise, vibration, construction dust, poor air quality and visual intrusion. In addition, the study area has regard to the proposed routeing of construction traffic and takes account of catchment areas for community facilities which could be affected where crossed by the Proposed Scheme. This study area includes land at: Stoke Mandeville; Marsh and Bishopstone; Western Aylesbury; Sedrup, Stone and Hartwell; and Fleet Marston.

5.3.3 Apart from land around Aylesbury (the main settlement in the area), the area is rural, characterised by farmland interspersed between these towns and villages. Outside these settlements the population is mainly located in farmhouses and rural cottages.

Stoke Mandeville

5.3.4 Stoke Mandeville is located to the south-east of Aylesbury and west of Weston Turville. The town and the majority of residential properties are centred on the A413 Wendover Road, A4010 Risborough Road and Station Road. There are also some properties on Marsh Lane and B4443 Lower Road. There are several community facilities within Stoke Mandeville including shops, a railway station, post office, the Wool Pack public house on the A4010 Risborough Road, the Bull Inn public house on A4010 Risborough Road, Bell public house on the B4443 Lower Road, St Mary the Virgin Church (C of E) and its associated burial ground, Stoke Mandeville Methodist Church, Stoke Mandeville Combined School, a community centre on Eskdale Road, playing fields and allotments. South of Stoke Mandeville is the graveyard of the former site of the Church of St Mary's, near to Mill House Farm off the A4010 Risborough Road. The Bucks Goat Centre (a children's animal farm with playground area and cafe) is also located on Old Risborough Road to the south of Stoke Mandeville.

Marsh and Bishopstone

5.3.5 The villages of Marsh and Bishopstone are located west of Aylesbury and Stoke Mandeville both centred on Bishopstone (the road).

5.3.6 Marsh is formed by a cluster of farms and associated residential properties. The only community facility in Marsh is The Prince of Wales public house.

5.3.7 Bishopstone is north-west of Marsh and is a slightly larger village with some residential properties located outside the village. The only community facility within the village is the Harrow public house.

Western Aylesbury

5.3.8 Aylesbury is located on intersections between the A4010 Risborough Road, A413 Wendover Road, A41 Bicester Road, and the A418 Oxford Road to the north-west of Stoke Mandeville. The area west of Aylesbury (west if the A41 Bicester Road) is characterised by housing estates and industrial estates. There are several community facilities in western Aylesbury including several schools (St Mary's C of E School; Pebble Brook School; St Henry Floyd Grammar School and Aylesbury College; Ashmead County Combined School; The Mandeville School; Booker School; Oak Green School) and several places of worship (including Fairford Leys Church; Church of Jesus Christ of Latter Day Saints; the Islamic Centre on Churchill Avenue; Church of the Good Shepherd; Guardian Angels Catholic Church; Seventh Day Adventist Church; St Mark's United Reform Church; Southcourt Church; Southcourt Baptist Church). There are also shops, public houses, children's nurseries; playing fields; health centres and doctor's surgeries; dentists; community halls and centres. Stoke Mandeville Hospital is located in the south of this area off Lower Road. Aylesbury Park Golf Club; Fairford Leys sports pitches and pavilion, which are adjacent to the golf club; the Round Aylesbury Walk (SMA/16 and SMA/17) and the Thame Valley Walk.

Sedrup, Stone and Hartwell

5.3.9 Sedrup, Stone and Hartwell are villages located on the A418 Oxford Road to the south-west of Aylesbury. The key community facilities within the villages include shops, post office, Bugle Horn public house, Bartlett's Residential Care Home, playing fields and Hartwell Riding Stables on the A418 Oxford Road. In addition, St Mary's Church is within the grounds of Hartwell Estate.

Fleet Marston

5.3.10 Fleet Marston, located north-west of Aylesbury, is a rural community comprising a few isolated cottages and farmsteads located in the vicinity of the A41 Bicester Road. The only community facility in the area is St Mary's Church and associated churchyard north-east of the A41 Bicester Road.

Future baseline

Construction (2017)

5.3.11 Volume 5: Appendix CT-004-025/1 provides details of the developments which are assumed to have been implemented by 2017. No committed developments have been identified in this study area that will materially alter the baseline conditions in 2017 for the community.

Operation (2026)

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

5.4 Effects arising during construction

Avoidance and mitigation measures

5.4.1 The A4010 Stoke Mandeville bypass has been incorporated into the scheme design as part of the design development process to remove the need for a bridge over the A4010 Risborough Road and its potential visual and noise effects for residents facing onto the Old Risborough Road and some receptors on the outskirts of Stoke Mandeville.

5.4.2 The draft CoCP includes a range of provisions that will help mitigate community effects associated with construction within this area, including the following (see Volume 5: Appendix CT-003-000/1):

- appointment of community relations personnel (draft CoCP, Section 5);
- community helpline to handle enquires from the public (draft CoCP, Section 5);
- sensitive layout of construction sites to minimise nuisance (draft CoCP, Section 5);
- where reasonably practicable, maintenance of PRoW for pedestrians, cyclists and equestrians around the perimeter of construction sites and across entry and exit points (draft CoCP, Section 5);
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions which may affect community resources during construction (draft CoCP, Section 5);
- specific measures in relation to air quality and noise will also serve to reduce impacts for the neighbouring communities including discretionary noise insulation for sensitive community resources and, in special circumstances, temporary rehousing (draft CoCP Sections 7 and 13); and
- where reasonably practicable, the avoidance of large goods vehicles operating adjacent to schools during drop off and pick up periods. (draft CoCP, Section 14).

Assessment of impacts and effects

5.4.3 Details of all assessments of community resources are included in Volume 5: Appendix CM-001-025. Each assessment form presents information that explains the rationale for determining the rating for sensitivity of the affected community resource, magnitude of impact and the assessment of significance.

Stoke Mandeville

Temporary effects

5.4.4 No significant temporary effects have been identified for the community of Stoke Mandeville.

Permanent effects

Residential properties

5.4.5 South-west of Stoke Mandeville the Proposed Scheme will cross A4010 Risborough Road and Old Risborough Road, both of which will be stopped up. TheA4010 Stoke Mandeville bypass will be put in place, west of Stoke Mandeville, from the southern junction between the A4010 Risborough Road and Old Risborough Road. The bypass will run alongside the Proposed Scheme, crossing over it adjacent to the existing Princes Risborough to Aylesbury Line. The bypass will then tie in with B4443 Lower Road south of Aylesbury, with a new roundabout. The tie in of the bypass will require the demolition of one residential property, 'Elmfield', 30 Lower Road. This property is within the design footprint of the roundabout. In terms of the effect on the local community of Stoke Mandeville, the permanent loss of this property will be minor adverse and therefore it is not considered to be significant at a community level.

5.4.6 Construction of the Proposed Scheme will require the permanent stopping up of Old Risborough Road and A4010 Risborough Road. These roads link the properties on Old Risborough Road and Whitethorn Close (approximately 13 residential properties in total, which border the land required for construction) with the community facilities in Stoke Mandeville which include: Stoke Mandeville Combined School, a nursery, a pre-school group, Stoke Mandeville Methodist Church, St Mary the Virgin Church (C of E), a post office, public houses, local shops and services and a community centre.

5.4.7 Presently residents of Whitethorn Close and Old Risborough Road require less than a 1km journey to the centre of Stoke Mandeville and its community facilities. As a result of the roads being stopped up, residents travelling by car will be required to use the A4010 Stoke Mandeville bypass and overbridge and then travel south along the B4443 Lower Road to reach Stoke Mandeville. This journey will be approximately 4km in total (therefore an additional journey of up to 3km). Individuals wishing to walk or cycle to Stoke Mandeville will be able to use a new subway, which will be built underneath the Stoke Mandeville South Embankment, with an additional journey length of up to 500m. There will also be a visual barrier between the residents of both Whitethorn Close and Old Risborough Road and Stoke Mandeville, in the form of the embankment and the noise fence barriers which will run along the top of the embankment. Whilst residents of Whitethorn Close and Old Risborough Road presently do not have a direct view of Stoke Mandeville, the Proposed Scheme will cause some visual isolation.

5.4.8 Residents of Whitethorn Close and Old Risborough Road are likely to need access to facilities in Stoke Mandeville on a regular basis and the new road will add up to 4.8km to a car journey and up to 500m to a pedestrian journey and there will also be a visual barrier between these residents and the rest of the Stoke Mandeville community. As such, the isolation effect on these properties is considered to be moderate adverse and is therefore significant.

Marsh and Bishopstone

Temporary effects

5.4.9 No temporary significant effects on communities in Marsh and Bishopstone have been identified within the assessment.

Permanent effects

5.4.10 No significant permanent effects on community resources in Marsh and Bishopstone arising from construction have been identified within the assessment.

Western Aylesbury

Temporary effects

5.4.11 No significant temporary effects have been identified for the community of western Aylesbury within the assessment.

Permanent effects

Community infrastructure

5.4.12 Aylesbury Park Golf Club is an important community resource that comprises an 18-hole golf course and a 9-hole short course, along with a driving range and children's activities. In addition, there is a clubhouse, changing rooms and a bar on-site. The golf club offers tuition and tournaments. There are currently around 350 to 375 members and a pay and play local customer base of over 4,000. Classes are also run for children of local schools and the club also runs tuition courses for people with learning difficulties (in conjunction with the local authority).

5.4.13 The nearest alternative 18-hole golf course to Aylesbury Park Golf Club is Weston Turville Golf Club, which is approximately 6km from Aylesbury Park, which offers both membership and pay and play options.[24]

5.4.14 The Proposed Scheme will pass through Aylesbury Park Golf Club. Approximately 25% of the land owned by the golf club (approximately 20ha of the 80ha site) will be required during construction of the Proposed Scheme and approximately 15% (approximately 12ha) will be required permanently for the embankment, cutting, a culvert at Lower Hartwell and two footbridges (Footpath SBH/32 overbridge and Bridleway SBH/2 overbridge). However, the remainder of the land at the golf club has been included within the boundary of the Proposed Scheme to facilitate the potential for reconfiguration of the golf course in combination with landscape and recreational opportunities. Therefore, whilst this part of the golf course will not be directly affected during construction of the railway, mitigation measures aimed at reducing the impact on the golf club and the wider community will affect use of the facility.

[24] Figures supplied by Aylesbury Park Golf Club via email, 27 February 2013.

5.4.15 Approximately 10 of the holes of the full golf course will be directly affected by the Proposed Scheme. The 9-hole short course is not within the land required for the construction or operation of the Proposed Scheme but will not continue as a standalone facility without the 18-hole course. As such, neither the 18-hole golf course nor the short course will be able to function in their present configuration from the point at which construction of the Proposed Scheme commences. This will mean that the golf club will not be able to continue operating during construction and the long term viability will depend on the delivery of a reconfigured golf course. If this does not prove possible the worst case effect will be that the golf club will cease operating.

5.4.16 Given that the Aylesbury Park Golf Club provides an important community resource and there are limited comparable local alternatives, this will be a major adverse effect and therefore is considered significant.

Sedrup, Stone and Hartwell

Temporary effects

5.4.17 No significant temporary effects for the communities of Sedrup, Stone or Hartwell have been identified within the assessment.

Permanent effects

Residential properties

5.4.18 East of Hartwell, the Proposed Scheme will cross the A418 Oxford Road. Earthworks associated with construction of the cutting and the A418 Oxford Road overbridge will require the demolition of Glebe House, a residential property on the A418 Oxford Road. In terms of the effect on the community of Hartwell it is considered that the permanent loss of this property will have a minor adverse effect. Therefore, the effect is not considered significant at a community level.

Fleet Marston

Temporary effects

5.4.19 No significant temporary effects on community resources in Fleet Marston arising from construction have been identified within the assessment.

Permanent effects

5.4.20 No significant permanent effects on community resources in Fleet Marston arising from construction have been identified within the assessment.

Cumulative effects

5.4.21 No significant cumulative effects on communities within the area arising from construction have been identified within the assessment.

Other mitigation measures

5.4.22 The assessment has concluded there are significant adverse effects arising during construction in relation to the Aylesbury Park Golf Club.

5.4.23 HS2 Ltd has been in discussions with the owners of the Aylesbury Park Golf Club regarding the impacts of the scheme and is seeking to enable the golf course to be reconfigured so that the golf club can continue to operate. For this reason, the land used by the golf club has been included within the wider landscape mitigation area around the A418 Oxford Road.

Summary of likely significant residual effects

5.4.24 In summary, residents of Whitethorn Close and Old Risborough Road in Stoke Mandeville will experience significant permanent isolation effects and the loss of land at Aylesbury Park Golf Club will result in a significant permanent effect on the resource and its users.

5.5 Effects arising from operation

Stoke Mandeville

5.5.1 Up to 10 residential properties in Stoke Mandeville, located on Old Risborough Road at Stoke House Estate are predicted to experience in-combination effects during the operation of the Proposed Scheme. These in-combination effects are:

- significant visual effects, due to clear views of the Proposed Scheme, overhead line equipment, and the new A4010 Risborough Road underpass; and
- significant operational noise effects.

5.5.2 The combination of these effects will have a major adverse effect on residential amenity and this is therefore considered to be significant.

Marsh and Bishopstone

5.5.3 No significant effects on the communities of Marsh and Bishopstone arising from operation of the Proposed Scheme have been identified within the assessment.

Western Aylesbury

5.5.4 No significant effects on the community of western Aylesbury arising from operation of the Proposed Scheme have been identified within the assessment.

Sedrup, Stone and Hartwell

5.5.5 No significant effects on the communities of Sedrup, Stone and Hartwell arising from operation of the Proposed Scheme have been identified within the assessment.

Fleet Marston

5.5.6 No significant effects on the community of Fleet Marston arising from operation of the Proposed Scheme have been identified within the assessment.

Cumulative effects

5.5.7 No temporary or permanent cumulative effects have been identified for any of the areas during operation.

Other mitigation measures

5.5.8 The assessment has concluded there are significant adverse effects arising during operation. No other mitigation measures are proposed.

Summary of likely significant residual effects

5.5.9 Following the incorporation of mitigation measures, there remains a permanent significant residual effect on the residential amenity of up to 10 residential properties in the south west of Stoke Mandeville.

6 Cultural heritage

6.1 Introduction

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

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

6.1.3 Maps showing the location of the key environmental features can be found in Map Series CT-10 (Volume 2, CFA11 Map Book). The location of all designated and non-designated heritage assets can be found on Maps CH-01-033b to CH-01-037a (Volume 5, Cultural Heritage Map Book). Detailed reports on the cultural heritage character and surveys undertaken within the study area are contained in the Volume 5 Appendices. These include:

- Appendix CH-001-011 – Baseline report;
- Appendix CH-002-011 – Gazetteer of heritage assets;
- Appendix CH-003-011 – Impact assessment table; and
- Appendix CH-004-001 – Survey reports.

6.1.4 Throughout this section, assets within the study areas are identified with a unique reference code, e.g. SMA001; further detail on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-011.

6.1.5 Engagement has been undertaken with Buckinghamshire County Council's planning archaeologist and the conservation officer for Aylesbury Vale District Council, with regard to the nature of the heritage assets within the Stoke Mandeville and Aylesbury study area.

6.2 Scope, assumptions and limitations

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

6.2.2 The setting of all designated heritage assets within the zone of theoretical visibility (ZTV) of the Proposed Scheme has been considered. The study area within which a detailed assessment of all assets, designated and non-designated, has been carried out, is defined as the land required, temporarily and permanently, for construction of the Proposed Scheme plus 500m.

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

6.2.4 In undertaking the assessment the following limitations were identified:

- the light imaging, detection and ranging (LiDAR)[25] data examined did not encompass the full extent of the study area; and
- not all areas of survey as identified in the archaeological risk model[26] were available for survey.

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

6.3 Environmental baseline

Existing baseline

6.3.1 In compiling this assessment, documentary baseline data was collected from a variety of sources as set out in Volume 5: Appendix CH-001-011.

6.3.2 In addition to collation of these baseline data the following surveys were undertaken:

- walkover and site reconnaissance from areas of public access or in locations where access was granted. This was undertaken to understand the character and form of heritage assets and the historic landscape, to review the setting of assets and to identify previously unknown assets;
- desktop review of remote sensing data LiDAR, aerial photographs and hyperspectral data (Volume 5: Appendix CH-004-011); and
- a programme of non-intrusive surveys comprising fieldwalking and geophysical surveys (Volume 5: Appendix CH-004-011).

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

Designated assets

6.3.3 The following designated heritage assets are located partially or wholly within the land required, temporarily or permanently, for the construction of the Proposed Scheme (see Maps CH-01-033b to CH-01-37a and CH-02-017 to CH-02-18 (Volume 5, Cultural Heritage Map Book)):

- Hartwell Park, a Grade II* registered park and garden (RPG) that forms part of the conservation area at Hartwell that together are an asset group of high value (SMA050); and
- Glebe House, a Grade II listed building of moderate value (SMA044).

6.3.4 The following designated assets are located within the ZTV of construction activities and shown on Maps CT-10-020b to CT-10-025a (Volume 2, CFA11 Map Book) and Maps CH-01-033b to CH-01-37a and CH-02-017 to CH-02-18 (Volume 5, Cultural Heritage Map Book):

- four scheduled monuments of high value: the motte and bailey castle at Weston Turville (within grouping SMA024); the medieval moated site at Marsh (SMA026); Eythrope deserted medieval village (SMA071); and the deserted medieval village and English Civil War earthworks at Quarrendon (SMA078);
- two Grade I listed buildings of high value: Church of St Mary, Weston Turville (within grouping SMA024) and Hartwell House (within grouping SMA050);
- eight Grade II* listed buildings of high value: the Manor House and Manor Farmhouse at Weston Turville (both within grouping SMA024); the Church of St Mary in Hartwell Park (within grouping SMA050); the statue of Prince Frederick in Hartwell Park (within grouping SMA050); the pavilion/cot at Hartwell Park (within grouping SMA050); the stable block and coach house at Hartwell House (within grouping SMA050); and St Mary's Church, Fleet Marston (SMA085);
- six conservation areas of moderate value: Church End, Weston Turville (within grouping SMA024); West End, Weston Turville (within grouping SMA024); Worlds End, Weston Turville (within grouping SMA024); Bishopstone (within grouping SMA039); Sedrup (within grouping SMA040); and Upper Hartwell (within grouping SMA052);
- the Grade II RPG of moderate value at Eythrope (SMA070); and
- a total of 100 Grade II listed buildings of moderate value. These are predominantly buildings within the settlements of Weston Turville (within grouping SMA024); Stoke Mandeville (within grouping SMA011); Bishopstone (within grouping SMA039); Sedrup (within grouping SMA041) and Stone (SMA051). There are 16 Grade II structures that are located within the inner park at Hartwell Park (within grouping SMA050). Grade II listed buildings also within the farmsteads at Stoke House (SMA007); Old Moat Farm (SMA022); Hall End (SMA023), Standall's Farm (SMA030); Whaddon Farm (SMA061); and Fleet Marston Farm (SMA091).

Non-designated assets

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

- remains associated with the former site of the Church of St Mary's at Stoke Mandeville (SMA003). These include the demolished ruins of the medieval church, its graveyard (last used for interment in 1908) and probable remains of a medieval manorial centre with mills, moated site and associated village remains. The site may also have been a Saxon ecclesiastical estate centre;
- potential Palaeolithic and Romano-British remains near Locke's Pit (SMA042). These may include Palaeolithic faunal and environmental remains and Romano-British cemetery evidence; and
- remains of a Romano-British small town on the Roman road of Akeman Street at Fleet Marston (SMA074) and associated Roman roads that lie within it (SMA075, SMA079, SMA080, SMA081 and SMA084).

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

- potential prehistoric/Romano-British features to the north-east of Stoke House (SMA004);
- Romano-British features identified on the A4010 Risborough Road (SMA009);
- part of a medieval moated site near Brook Cottage (SMA012);
- prehistoric and Romano-British activity south-west of Stoke Mandeville Hospital (SMA027);
- prehistoric and Romano-British remains between Walton Court and Bishopstone (SMA034);
- probable medieval village in Hartwell Park (SMA054);
- possible medieval settlement in the northern section of Hartwell Park (SMA062); and
- ten hedgerows qualifying as historically important under the Hedgerow Regulations 199727 (SMA002, SMA005, SMA008, SMA014, SMA019, SMA020, SMA036, SMA037, SMA068 and SMA094).

[27] The Hedgerows Regulations (1997), Statutory instrument 1997, 1160. HMSO. London.

6.3.7 All non-designated heritage assets within 500m of the land required, temporarily or permanently, for construction of the Proposed Scheme are listed in the gazetteer in Volume 5: Appendix CH-002-011 and shown on Maps CH-01-033b to CH-01-37a (Volume 5, Cultural Heritage Map Book). There are a number of built heritage assets with upstanding remains, the settings of which have been considered, for example:

- the Stoke Mandeville village envelope (SMA096)
- the Stoke Mandeville landscape (SMA097);
- Millhouse Farm (SMA095);
- deserted medieval village earthworks to the south of Stoke Mandeville (SMA010);the Sedrup landscape (SMA100);
- Park Villa, Hartwell Cottage and The Oaks (SMA101); and
- Putlowes Farm (SMA088).

Cultural heritage overview

6.3.8 The area around Aylesbury and the Greensand Belt at the foot of the Chiltern Scarp is identified in the Solent Thames Archaeological Research Framework[28] as having experienced relatively intensive human activity from at least the Mesolithic (circa 10,000 – 4,000 BC) period and probably from the Palaeolithic (circa 500,000 – 10,000 BC) through to the post-medieval (AD 1539 – 1900) period.

6.3.9 Human activity through all periods in this area has largely been concentrated on more easily worked and better drained soils, particularly over the Terrace Gravels and better draining upper slopes adjacent to, or within tributary valleys draining to the River Thame. The route of the Proposed Scheme broadly follows one of these valleys, draining from the Greensand north and east to the River Thame and thence to the River Thames.

6.3.10 Palaeolithic faunal remains, including fragments from mammoth, woolly rhinoceros, hippopotamus, bear and hyena have been recovered during 19th and early 20th century quarrying at Locke's Pit (SMA042) between Walton and Hartwell. These finds were derived from the Pleistocene Terrace Gravels that overlie the Greensand and Gault within the valley in this area.

6.3.11 Typically Mesolithic activity may be identified on upper slopes with well drained soils overlooking watercourses; such as within the valley between Walton Court and Bishopstone and on the flanks of the Thame Valley near Haydon Mill and at Fleet Marston.

[28] Oxford Archaeology and Buckingham County Council (ongoing) *Solent Thames Archaeological Research Framework. Oxford*

6.3.12 The Greensand Ridge at the foot of the Chiltern Scarp in the Aylesbury area is likely to have been an important area for Neolithic and Early Bronze Age settlement (circa 4,000 – 1,500 BC). Such sites of these periods may be expected on slopes over well drained soils and overlooking watercourses. The valley between Walton Court and Bishopstone and on the flanks of the Thame Valley near Haydon Mill and at Fleet Marston would be typical locations for activity of this date. Neolithic activity has been identified within the area of Coldharbour Farm (SMA058), west-south-west of Aylesbury.

6.3.13 From the Middle Bronze Age settlement was becoming more permanent, usually as single farmsteads only large enough to accommodate a single family unit. There is extensive evidence for Middle Bronze Age through to Late Iron Age (circa 1,500 BC – AD 43) settlement and agricultural systems recorded from the Aylesbury area with important sites having been excavated at:

- Aston Clinton (outside of the study area);
- Bierton (outside of the study area);
- Coldharbour Farm (SMA058);
- near Stoke Mandeville Hospital (SMA027);
- between Walton Court and Bishopstone (SMA034);
- in Walton Court (SMA035); and
- within Aylesbury (SMA048).

6.3.14 Pre-Roman activity has also been identified at Fleet Marston (SMA074) and Berryfields (SMA077).

6.3.15 The evidence from Aston Clinton and elsewhere suggests that prehistoric routeways onto the Chilterns may survive in the Aylesbury area, fossilised as modern tracks and minor roads.

6.3.16 A Romano-British small town has been identified in the area of Fleet Marston and Putlowes (SMA074); evidence from this area suggests the presence of a possible Roman Conquest period fort on the Roman road of Akeman Street, that later developed into a town.

6.3.17 The settlement at Fleet Marston appears to have been extensive and stands on the junction of Akeman Street (SMA076). There is a second road (SMA082 and SMA083) that follows an alignment north to a crossing of the River Great Ouse and potential cult centre at Thornborough, near Buckingham.

6.3.18 Ritual and burial activity is also suggested at Fleet Marston by recorded finds of cremations, a lead sarcophagus, a pewter hoard and the site of a possible Romano-British temple. Any Romano-British cemeteries at Fleet Marston are most likely to lie alongside Akeman Street and the road leading north towards Thornborough, although burials within the bounds of the settlement are also possible.

6.3.19 The small town at Fleet Marston was likely to have developed an extensive hinterland of agricultural settlements in order to support it both in the form of farmsteads and villa estates. The quality of agricultural land appears to have been an important factor in locating Roman period settlements with lighter, more fertile and freely draining soils being generally preferred for arable usage. Heavier less workable and fertile soils, including those over clay, were often utilised for pasture and possibly managed woodland, although arable farming was also widespread on such soils. Part of this hinterland, including farmsteads with associated field systems, has been identified during investigations at Berryfields (SMA077).

6.3.20 Romano-British villas developed in Southern England from Late Iron Age settlements in the late 1st to early 2nd century AD, although the development of established villa estates appears to be absent from the Aylesbury area. Settlement is instead composed of farmsteads, one of which may lie at Nash Lee to the south of Stoke Mandeville with others being recognised at Aston Clinton (outside of the study area), Walton Court (SMA035) and at Berryfields, Billingsfield and Aylesbury Vale Parkway (SMA077). Further evidence for settlement of Roman date has been recorded at Walton Court and Walton High School (SMA035), Aston Clinton, and Buckingham Street, Aylesbury.

6.3.21 As well as at Fleet Marston, extensive areas of later Romano-British settlement are suggested to the south of Aylesbury by findspots and evidence recovered during archaeological evaluations and excavations. This includes a Roman cemetery at Locke's Pit (SMA042) and geophysical survey results indicating a complex system of enclosures associated with finds from between Walton Court and Bishopstone (SMA034). Another potential Romano-British site comprising a ladder like arrangement of fields or paddocks aligned along a probable trackway with a large offset rectangular enclosure (SMA004), has been identified to the east of the former site of the Church of St Mary's at Stoke Mandeville (SMA003).

6.3.22 Understanding what was occurring in the 5th to 7th centuries AD is challenging. Material culture was drastically reduced as handmade Anglo-Saxon pottery does not survive well in plough soils and coinage is only present reliably from approximately AD 700 and even then is rare. Much of the evidence for the 5th to 7th centuries comes from cemeteries, although place names can also be a useful indicator of settlement activity of this period. Early Saxon cemeteries have been identified near Sedrup (SMA040) and possibly also at Hartwell (SMA050). A local name of Tetlow (SMA029) near Bishopstone is also suggestive of an Early Saxon burial ground.

6.3.23 The social, monetary, economic and political organisation of the Roman period broke down to be replaced by a system of smaller tribal entities. The period appears to have been unsettled and warlike as these entities strove for power until the principal Anglo-Saxon kingdoms of East Anglia, Mercia and Wessex became established. The study area lies in an area in which all three of these kingdoms exerted an influence, although between the 8th to 9th centuries Mercia held sway. From the 7th century onwards the archaeological record becomes clearer as documentary sources become available and the evidence from buried artefactual and structural remains become more robust. The area lay at the southern edge of the Anglo-Saxon kingdom of Mercia with its southern rival Wessex, the boundary of which generally lay along the River Thames.

6.3.24 From the 8th century a significant settlement had developed at Aylesbury that was a mint for short periods in the 10th and 11th centuries. Aylesbury also became an important Middle Saxon Royal estate with an associated ecclesiastical grant of a Minster church. It is unlikely that Saxon Aylesbury existed in isolation and it is likely that the medieval villages of the area had early medieval origins.

6.3.25 This period also saw the establishment of the open field agricultural system with its characteristic ridge and furrow, which would have remained in use throughout the medieval period. These open fields were worked communally with farmers owning and/or renting individual portions/strips within each of the open fields. The study area stands on the division between the 'Champion' medieval landscapes of nucleated villages with large open field systems typical of the Vale of Aylesbury and the other Midland counties and the more dispersed pattern of smaller hamlet and farmstead typical of the Chilterns. By the time of the Norman Conquest (AD 1066) the present day settlement pattern had probably already developed focused on the settlements of Stoke Mandeville (SMA011), Bishopstone (SMA039), Sedrup (SMA041), Hartwell (SMA052 and SMA053), Walton and Aylesbury.

6.3.26 A possibly high status medieval site appears to be present surrounding the former site of the Church of St Mary's (SMA003) to the south of Stoke Mandeville. Earthworks typical of medieval settlement, including probable mill leats, trackways and house platforms, surround the demolished medieval church. It is likely that this settlement was an important ecclesiastical holding through much of the medieval period. The Church of St Mary at Fleet Marston (SMA085) is also surrounded by the buried remains of its associated medieval settlement.

6.3.27 Evidence for medieval (AD 1066 – 1539) settlement is clearly represented by the scheduled monuments of moated sites that lie outside of the study area at Terrick House, Grove Farm, Elmbrook Farm and Apsley Manor Farm. In addition, extensive areas of former medieval settlement exist as earthworks at the scheduled monument of Quarrendon (SMA078), south of Stoke Mandeville (SMA010), at Eythrope (SMA071), at Putlowes (SMA088) and at Sedrup (SMA041). A number of moated sites and/or manorial centres have also been identified, some with potential fishponds, around Stoke House (SMA006) near Brook Farm (SMA012); at Moat Farm (SMA022); near Hall End (SMA023); and near Upper Cranwell Farm (SMA092). These would have formed the focus for settlement and may represent colonisation of more marginal land during 12th to 13th centuries when population expansion exerted pressure on established settlements. Some may also represent development of land grants to churches and monastic institutions and/or assarting (grants to clear woodland) of woodland.

6.3.28 The post-medieval period (1539 – 1900) also witnessed the widespread abandonment of the medieval agricultural organisation based on open fields with its ridge and furrow strips divided by headlands. Enclosed fields, both for arable production and to provide enclosed pasture, replaced this. The enclosure of the landscape commenced in the later medieval period and accelerated after the final dissolution of the monasteries under Henry VIII between 1536 and 1539, which brought more land into private ownership and the commensurate rise of a gentrified class.

6.3.29 A number of large houses established by gentry are present within the study area and are often associated with surrounding planned estates, parks and gardens. These include the Grade I listed Hartwell House (within grouping SMA050), which lies at the heart of the late 17th to 19th century Grade II* RPG at Hartwell. This was linked by an avenue with another house, owned in the mid-17th century by the patriot John Hampden and set amongst the scheduled monument of the deserted medieval villages at Quarrendon (SMA078). This parkland was probably originally designed for the Lee family in the late 17th century by the local gardener James Neale before being re-worked in the 1730s by James Gibbs. The garden was wholly redesigned in the 1760s in the new picturesque style by Richard Woods, a student of Capability Brown.

6.3.30 Designed landscapes were also established in the 18th century around what would become the Rothschild estate at Eythrope (SMA070) and greatly altered by Alice Rothschild in the 1870s. This is a Grade II RPG that occupies the higher ground formed by the Portland/Purbeck limestones with views heading north towards Aylesbury.

6.3.31 Many of the farmhouses and associated agricultural buildings in the area were built between the 17th and 19th centuries as enclosure (both private and parliamentary) heralded a fundamental reorganisation of farming practices and of the countryside. This led to the abandonment of the communal open field farming system in strips and the consolidation of private and tenanted farmland as discrete farmstead. Examples of farmsteads established during or immediately after enclosure include Standall's Farm (SMA30) and Whaddon Hill Farm (SMA061).

6.3.32 Reorganisation of the countryside was accompanied by an associated change in labour division. A lower proportion of the rapidly expanding population could be employed on the land while the demands of industry and commerce led to a burgeoning urban population. Aylesbury continued to be an important market and county town and from the 19th century onwards it and its satellite settlements (such as Stoke Mandeville) expanded outwards from their cores. New markets for the agricultural produce of the Aylesbury area were opened up by the improvement of roads in the late 18th and 19th centuries and the construction of the railways providing a fast link to both London and the industrial heartland of the Midlands.

6.3.33 The urban expansion of Aylesbury and other settlements and infrastructure encouraged the development of local extractive industries to furnish bricks, mortar road stone and ballast. Post-medieval industry is also represented within the study area by the gravel and clay extraction pits that were worked between Hartwell and Walton during the 19th and 20th centuries. Further changes have also been made to the local landscape by alterations to post-medieval field boundaries to facilitate modern mechanised agricultural practices.

6.3.34 At Sedrup, there was a camp to house Italian prisoners of war established during World War II. Hartwell House and its grounds was utilised as a billet for housing troops being trained for D-Day.

6.3.35 During the 1850s to 1870s the parkland at Hartwell (SMA050) was expanded to the east by incorporation of former agricultural land. This area does not have an equivalent parkland character to the inner park immediately surrounding Hartwell House and since the 1990s has been developed as a golf course and public sports pitches.

6.3.36 The Church of St Mary's at Stoke Mandeville (SMA003) gradually fell into ruins and was replaced by a new Church of St Mary's (SMA097) within the post-medieval core of Stoke Mandeville in the 1850s. The burial ground around the abandoned church remained in use for the occasional interment through until 1908. The ruins became ever more dangerous and were finally demolished with explosives by the Royal Engineers in the 1960s.

6.3.37 Aylesbury has continued to expand outwards from its core with the town centre now being surrounded by mainly later 20th and early 21st century residential estates, light industry and retail parks.

Future baseline

Construction (2017)

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

Operation (2026)

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

6.4 Effects arising during construction

Avoidance and mitigation measures

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

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

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

- use of an embankment and culvert to reduce the visual intrusion of the Proposed Scheme within the Hartwell Parkland (SMA050); and
- limiting the extent of the land required to construct the Proposed Scheme as it crosses the Romano-British small town at Fleet Marston (SMA074).

Assessment of impacts and effects

Temporary effects

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

6.4.4 Stoke House (SMA007), a Grade II listed building of moderate value will be subject to changes to its setting from construction activities (construction of the route, establishment of haul routes, construction of sidings, landscaping and construction of balancing ponds) which will be clearly visible within 200m to the south of the house over a period of three years. These activities will interrupt the view from the front of the house over an agricultural landscape that provides a historic context in which the house can be appreciated. Construction activities will also be present within 100m to the west of the house over a period of approximately three years. This will remove part of the agricultural setting that lends weight to the value of Stoke House. This will constitute a high adverse impact and a major adverse effect.

6.4.5 The Grade II* registered park and conservation area at Hartwell (SMA050) with one Grade I, four Grade II* and 16 Grade II listed buildings and structures will be bisected by the Proposed Scheme. Construction of the Proposed Scheme in cutting and temporary material stockpiles will be visible in the principal view from Hartwell House along the avenue to the north (see Section 9) over a period of approximately two years. Construction noise will also change the setting of the parkland (particular the inner park around Hartwell House). Together these changes will partially remove the parkland landscape and alter its character and the ability to understand its historical legibility, integrity and coherence. This is an asset grouping of high value. This will constitute a high adverse impact and a major adverse effect.

6.4.6 The medieval earthworks to the south of Stoke Mandeville (SMA010), an asset of moderate value, will have construction activities visible to their south over a period of approximately three years. Noise from construction activities will also change the setting of the earthworks over this period. These changes will noticeably affect the ability to understand and appreciate these earthworks within their historic landscape context. This will constitute a medium adverse impact resulting in a moderate adverse effect.

6.4.7 The Stoke Mandeville village envelope (SMA096), an asset of moderate value, will have construction activities visible to its south over a period of approximately three years. This area will also experience construction noise which will change the setting of the asset during this period. These changes will noticeably affect the ability to understand and appreciate this landscape component. This will constitute a medium adverse impact resulting in a moderate adverse effect.

6.4.8 Old Moat Farmhouse (SMA022), a Grade II listed building of moderate value, will be subject to changes in its setting during construction of the Proposed Scheme. Construction activities will be heard and also partially visible and within the agricultural landscape to the south of the asset over a period of approximately three years. This will partially remove the agricultural setting from which Hall End derives some of its value. This constitutes a medium adverse impact and a moderate adverse effect.

6.4.9 Hall End (SMA023), a Grade II listed building of moderate value, will be subject to changes to its setting due to construction of the new A4010 Stoke Mandeville bypass within 100m over a period of approximately two years. Construction of the bypass will sever Hall End from its agricultural hinterland on its west side and put construction activities within the view from the front elevation of the house. This will partially remove the agricultural setting from which Hall End derives some of its value. This constitutes a medium adverse impact and a moderate adverse effect.

6.4.10 Sedrup (SMA041), a historic settlement of moderate value within a conservation area comprising seven Grade II listed buildings will be subject to changes to its setting during construction of the Proposed Scheme. The principal views from Sedrup overlook the agricultural land in which the Proposed Scheme will be constructed. During the construction period, construction activities will be visible over a period of approximately three years (see Section 9) altering the historical legibility and coherence of this landscape. This will partially remove the agricultural setting from which Sedrup derives much of its value. This will constitute a medium adverse impact and a moderate adverse effect.

6.4.11 The Sedrup landscape (SMA100), an asset of moderate value, will have construction activities visible to its north over a period of approximately three years. Construction of the Aylesbury embankment, realignment of the A418 Oxford Road, Aylesbury north cutting and associated temporary material stockpile and establishment of landscaping will noticeably affect the ability to understand and appreciate this landscape component in its historic landscape context. This will constitute a medium adverse impact resulting in a moderate adverse effect.

6.4.12 Lower Hartwell (SMA053), a historic settlement of moderate value, within a conservation area comprising six Grade II listed buildings will be subject to changes to its setting during construction of the Proposed Scheme. The construction of the Proposed Scheme will be visible within the parkland at Hartwell House over a period of approximately two years (See Section 9). Construction noise will also be experienced in this area. This and the visibility of the scheme within a well-preserved historic landscape in the parkland to the east will alter the historic integrity and coherence of Lower Hartwell's setting. This will partially remove the agricultural and

parkland setting from which Lower Hartwell derives much of its value. This will constitute a medium adverse impact and a moderate adverse effect. This will partially remove the agricultural and parkland setting from which Lower Hartwell derives much of its value. This will constitute a medium adverse impact and a moderate adverse effect.

Cumulative effects

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

Permanent effects

6.4.14 Permanent significant effects can occur either as a result of physical impacts on heritage assets within the land required, temporarily or permanently, for construction of the Proposed Scheme, or through changes to the setting of heritage assets through the presence of the Proposed Scheme.

Physical Impacts

6.4.15 Construction of the Proposed Scheme will remove buried archaeological remains including the former church and burial ground with associated settlement and mill remains around the former site of the Church of St Mary's at Stoke Mandeville (SMA003), an asset of high value. Construction of the Proposed Scheme here will involve establishment of haul route, construction of the route and maintenance loop; landscaping; a balancing pond; utility diversions; temporary spoil storage; and flood plain compensation. This will constitute a high adverse impact and a major adverse effect.

6.4.16 The landscape associated with the site of the former Church of St Mary's at Stoke Mandeville (SMA097), an asset of moderate value, will be almost entirely removed by construction of the Stoke Mandeville south embankment and maintenance loop. The coherence and legibility of the historic landscape character of this area will be comprehensively altered. This will constitute a high adverse impact and a major adverse effect.

6.4.17 Construction of the new A4010 Stoke Mandeville bypass will remove buried archaeological remains associated with a Romano-British site on Risborough Road (SMA009), an asset of moderate value. This will constitute a high adverse impact and a major adverse effect.

6.4.18 Glebe House (SMA044), a Grade II listed building of moderate value will be demolished by construction of the route in cutting. This will constitute a high adverse impact and a major adverse effect.

6.4.19 The Grade II* RPG and conservation area at Hartwell (SMA050) with one Grade I, four Grade II* and 16 Grade II listed buildings and structures will be bisected by the Proposed Scheme resulting in severance of a historic landscape and changes in setting(s) that will affect the value of the asset group. The asset group is of high value. Construction of the Proposed Scheme will effectively remove the eastern portion of the parkland that was added to the Hartwell park landscape in the 1870s and will sever

the inner park surrounding Hartwell House and the associated listed parkland features from any connection with the removed section of the parkland. Construction of the Proposed Scheme will also remove part of, and sever, the avenue within the principal view from Hartwell House. Although the Proposed Scheme will be concealed within the Thame Valley viaduct cutting (see Section 9) the pedestrian movement along the avenue, a design feature of the park, will be interrupted. This is an asset grouping of high value. This will constitute a high adverse impact and a major adverse effect.

6.4.20 Construction of the Proposed Scheme will remove archaeological remains identified between Walton Court and Bishopstone (SMA034), an asset of moderate value. Construction in this area will include haul route; construction of the Aylesbury embankment; landscaping; temporary spoil storage; Footpath SMA/16 accommodation overbridge; Bridleway SBH/27 overbridge; a balancing pond and planting. This will constitute a high adverse impact and a major adverse effect.

6.4.21 Construction of the Proposed Scheme will remove archaeological remains identified around Locke's Pit (SMA042), an asset of high value. Construction here will include haul routes; realignment of the A418 Oxford Road; construction of the route in cutting; temporary spoil storage; landscaping; and new planting. This will constitute a high adverse impact and a major adverse effect.

6.4.22 Construction of the Proposed Scheme will remove archaeological remains of medieval settlement (SMA054) within the parkland at Hartwell, an asset of moderate value. Construction here will comprise a haul route; construction of the route on embankment with culvert; a balancing pond; flood plain compensation; landscaping and Footpath SBH/32 overbridge. This will constitute a high adverse impact and a major adverse effect.

6.4.23 Construction of the Proposed Scheme will remove archaeological remains within the Romano-British small town/roadside settlement at Fleet Marston (SMA074), an asset of high value. Construction will comprise a haul route; temporary spoil storage; construction of the route (on Thame Valley north embankment, in Putlowes cutting, and on A41 Bicester Road embankment); Putlowes accommodation overbridge; Bridleway FMA/1 accommodation overbridge; Putlowes auto-transformer station; Fleet Marston culvert; landscaping; new plantings and temporary spoil stockpiling. This will constitute a high adverse impact and a major adverse effect.

6.4.24 Construction of the Proposed Scheme will remove buried archaeological remains of enclosures (SMA089), an asset of moderate value, of probable prehistoric or medieval date an asset of moderate value. Construction will include establishment of the A41 Bicester Road embankment main compound. This is will constitute a high adverse impact and a major adverse effect.

6.4.25 Construction of the Proposed Scheme will remove buried archaeological remains associated with a prehistoric or Romano-British site to the north-east of Stoke House (SMA004), an asset of moderate value. Construction will comprise the haul route; construction of the route with sidings and access track. This will constitute a medium adverse impact and a moderate adverse effect.

6.4.26 Construction of the new A4010 Stoke Mandeville bypass will remove buried archaeological remains associated with prehistoric and Romano-British remains to the south-west of Stoke Mandeville Hospital (SMA027), an asset of moderate value. This will constitute a medium adverse impact and a moderate adverse effect.

6.4.27 Construction of the Proposed Scheme will remove archaeological remains of medieval settlement (SMA062) to the north of the parkland at Hartwell, an asset of moderate value. Construction will comprise the haul route; construction of the route within the Thame Valley viaduct cutting; and Bridleway SBH/2 overbridge. This will constitute a medium adverse impact and a moderate adverse effect.

6.4.28 Ten sections of hedgerow that meet the criteria of the Hedgerow Regulations 1997 as being historically important (SMA001, SMA005, SMA008, SMA014, SMA019, SMA020; SMA036, SMA037, SMA068 and SMA094), assets of moderate value will be removed within the land required for construction of the Proposed Scheme. This will constitute a medium adverse impact and a moderate adverse effect.

Impacts on the setting of heritage assets

6.4.29 Stoke House (SMA007), a Grade II listed building of moderate value will be subject to changes to its setting derived from changed views to the south from the principal front elevation of the house. The route and associated maintenance loop with landscaping and planting will effectively sever the southward view across the agricultural hinterland associated with Stoke House and which adds value in connecting it to its rural setting. The night time setting of the asset will also be affected by the lighting within the maintenance loop. This will constitute a medium adverse impact and a moderate adverse effect.

6.4.30 Hall End (SMA023) an asset of moderate value will have construction activities within 100m to its west for bypass construction and 400m to its south for construction of the route. The insertion of the bypass into the agricultural landscape to the west of Hall End will sever the asset from its agricultural setting on this side and impinge on views from the asset's front elevation. The setting of the asset will be noticeably different affecting its value through changes in our ability to understand and appreciate the asset in its historical context and setting. This constitutes medium adverse impact and a moderate adverse effect.

Permanent cumulative effects

6.4.31 Assessment of inter-project effects on cultural heritage assets arising from the interaction of the Proposed Scheme with cumulative development projects has been undertaken.

6.4.32 Removal of archaeological remains of the Romano-British small town at Fleet Marston (SMA074) during construction of the Proposed Scheme should be considered in conjunction with the removal of archaeological remains during construction of the new developments at Berryfields MDA (SMA077). Together this will result in the loss of archaeological remains of both the settlement at Fleet Marston and a portion of its immediate hinterland. This is considered to have a cumulative medium adverse impact and a major adverse effect.

Other mitigation measures

6.4.33 Refinements to the mitigation measures incorporated into the design of the Proposed Scheme or included in the draft CoCP will be considered during detailed design to reduce further the significant effects described above. These refinements will include the identification of:

- suitable locations for advance planting, to reduce impacts on the setting of assets; and
- locations where the physical impact on below ground assets can be reduced through the design of earthworks.

Summary of likely residual significant effects

6.4.34 A range of archaeological assets will be permanently lost due to the construction of the Proposed Scheme. These assets include: the remains associated with the former site of the Church of St Mary's, Stoke Mandeville (SMA003), the Romano-British site on A4010 Risborough Road (SMA009), prehistoric/Romano-British remains to the south-west of Stoke Mandeville Hospital (SMA027), prehistoric and Romano-British site between Walton Court and Bishopstone (SMA034), archaeological remains around Locke's Pit (SMA042), remains of medieval settlement in Hartwell House RPG (SMA054), remains of a medieval settlement to the north of Hartwell House RPG (SMA062), Fleet Marston Romano-British small town (SMA074), and enclosures south of Fleet Marston cottages (SMA089). A programme of archaeological works will be prepared to investigate, analyse, report and archive these assets.

6.4.35 The Proposed Scheme will result in the demolition of Glebe House (a Grade II listed building). A programme of built heritage works will be prepared to investigate, analyse, report and archive this asset.

6.4.36 The setting of several historic settlements, buildings and landscapes will be affected by the presence of the constructed Scheme, including landscaping, overbridges and other associated infrastructure. This presence will affect these assets through physical loss or severance of landscape elements or disruption of landscape associations that contribute to their value. These include: Hartwell House RPG (SMA050), Stoke House (SMA007), Hall End (SMA023), Sedrup (SMA041), and Lower Hartwell (SMA053). Sections of 10 historically important hedgerows will also be removed.

6.5 Effects arising from operation

Avoidance and mitigation measures

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

- noise mitigation measures have been included within the scheme design to reduce potential impacts on identified assets;
- landscaping and planting within the outer park at Hartwell (SMA050) to reduce the impact on the setting of the inner park and listed buildings, including the

Grade I listed Hartwell House; and

- locating the A418 Oxford Road to the south of the Hartwell House RPG (SMA050) to alleviate the impact from traffic on the Hartwell House RPG and to restore a quiet avenue along the parkland's southern edge.

Assessment of impacts and effects

6.5.2 The assessment considers the Proposed Scheme once operational and all effects are considered to be permanent. There will be no physical impacts on buried archaeological remains or other heritage assets arising from the operation of the Proposed Scheme. Impacts on the setting of heritage assets arising from the physical presence of the Proposed Scheme are described as permanent occurring within the construction phase and are not repeated in detail here, albeit that they will endure through the operation of the Proposed Scheme. All effects reported below are considered significant unless stated otherwise. Where there is a combined effect on the setting of an asset from the presence of the Proposed Scheme and its operation, this is reported in the assessment of operation.

6.5.3 The Grade II* RPG and conservation area at Hartwell (SMA050) with one Grade I, four Grade II* and 16 Grade II listed buildings and structures, an asset of high value, will have a changed setting due to movement of trains and associated increase in noise. The comparatively quiet noise environment of the park, is a feature of the original park design and contributes to the appreciation of the setting and the significance of the park. This change in noise will remove the peaceful ambience of the inner park which forms a key element of its value. This will constitute a medium adverse impact and a major adverse effect. In combination with the presence of the constructed scheme, this will result in a high adverse effect resulting in a major adverse effect.

6.5.4 Stoke House (SMA007), a Grade II listed building of moderate value will be subject to changes to its setting derived from the movement of trains and associated increase in noise and changes to the agricultural landscape at night due to lighting within the maintenance loop. This will alter the isolated nature of the agricultural landscape in which Stoke House stands and which lends weight to its value. This will constitute a medium adverse impact and a moderate adverse effect. In combination with the presence of the constructed scheme this will result in a high adverse impact resulting in a major adverse effect.

6.5.5 The medieval village earthworks to the south of Stoke Mandeville (SMA010) will experience an increase in noise levels which will alter the nature of the local soundscape, an aspect which lends weight to its value. This will constitute a medium adverse impact resulting in a moderate adverse effect.

6.5.6 Increased noise levels from the movement of trains at the Stoke Mandeville village envelope (SMA096) will have a noticeable impact on the ability to understand and appreciate the historic landscape context of the asset. This will constitute a medium adverse impact resulting in a moderate adverse effect.

6.5.7 Increased noise levels from the movement of trains at Old Moat Farmhouse (SMA022) will alter the nature of the local soundscape which lends weight to its value. This will constitute a medium adverse impact resulting in a moderate adverse effect.

6.5.8 Lower Hartwell (SMA053) will experience changes to its local sound environment from the movement of trains. This will have a noticeable impact on the ability to understand and appreciate this asset within its historic landscape context. This will constitute a medium adverse impact resulting in a moderate adverse effect.

6.5.9 Putlowes Farm (SMA088) will experience changes to its local sound environment from the movement of trains. This will have a noticeable impact on the ability to understand and appreciate this asset within its historic landscape context. This will constitute a medium adverse impact resulting in a minor adverse effect. In combination with the presence of the constructed Scheme this will result in a high adverse effect resulting in a moderate adverse effect.

Cumulative effects

6.5.10 Assessment of inter-project effects on cultural heritage assets arising from the interaction of the Proposed Scheme with cumulative development projects has been undertaken. These are listed in Volume 5: CT-004-000 and shown on Maps CT-13 (Volume 5, Cross Topic Appendix 1 Map Book). No significant cumulative effects have been identified in relation to cultural heritage as none of the identified projects are likely to affect the assets affected by the Proposed Scheme.

Other mitigation measures

6.5.11 The Proposed Scheme includes a number of design measures to address potential impacts and significant effects. No additional operational mitigation measures beyond those included within the Proposed Scheme design have been identified.

Summary of likely residual significant effects

6.5.12 The setting of several historic settlements, buildings and landscapes will be permanently affected visually and by noise once the Proposed Scheme becomes operational. This includes: Hartwell Park (SMA050), Stoke House (SMA006), the deserted medieval village earthworks to the south of Stoke Mandeville (SMA010), the Stoke Mandeville village envelope (SMA096), Old Moat Farmhouse (SMA022), Lower Hartwell (SMA053), and Putlowes Farm (SMA088). In due course visual effects will reduce as planting matures and the Proposed Scheme integrates into the landscape.

6.5.13 Operational noise will be controlled through noise fence barriers and screening earthworks adjacent to the Proposed Scheme, see Section 11.

7 Ecology

7.1 Introduction

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

7.1.2 Principal ecological issues in this area include the loss of grassland from the northern end of the Grassland at North Lee Biological Notification Site (BNS); the loss of a brown long-eared bat maternity roost; and the loss and fragmentation of habitat used by adder, grass snake, and great crested newts near Aylesbury Park Golf Club and Fleet Marston.

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

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

7.1.4 As well as survey data, the assessment draws on existing information gathered from national organisations and from regional and local sources including: Buckinghamshire and Milton Keynes Environmental Records Centre; Environment Agency; Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust; Buckinghamshire Bird Club; and the North Bucks Bat Group.

7.2 Scope, assumptions and limitations

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

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

7.2.3 Access was not obtained to all of the land area where general habitat survey (Phase 1 habitat survey) was proposed. Locations with the potential to support key ecological receptors where access could not be gained for survey include farmland east of Eythrope. In addition, access was not secured for properties along the B4443 Lower Road, land located south-west of the B4443 Lower Road and land situated north-east of the Proposed Scheme at Stoke Mandeville until June 2013, thus limiting survey work in this area. Further details are provided in Volume 5: Appendices EC-001-002, EC-002-002, EC-003-002 and EC-004-002.

7.2.4 A Habitats Regulations Appraisal (HRA) screening exercise was undertaken in 2013. This concluded no likely significant effect on the Chilterns Beechwoods Special Area of Conservation (SAC) from the Proposed Scheme. The HRA screening report is presented in Volume 5: Appendix EC-010-002.

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

7.2.6 The precautionary approach to the assessment has been adopted to identify the likely significant ecological effects of the Proposed Scheme.

7.3 Environmental baseline

Existing baseline

7.3.1 This section describes the ecological baseline relevant to the assessment: the designated sites, habitats and species recorded in this area. Further details are provided in the reports and maps presented in Volume 5 (Appendix EC-001-002 to EC-004-002 and Maps EC-001 to EC-12, Volume 5, Ecology Map Book). Statutory and non-statutory designated sites are shown on Volume 5, Map EC-01.

7.3.2 Land required for the construction of the Proposed Scheme and that adjacent to it consists of predominantly flat arable fields and pasture bounded by hedgerows, often with ditches. The area contains numerous watercourses, including the Stoke Brook, south of Stoke Mandeville and the River Thame, north-west of Aylesbury. Few woods are present, but ponds are abundant, particularly in the central and northern parts of this area. Aylesbury town dominates the landscape to the west of the land required for the construction of the Proposed Scheme.

Designated sites

7.3.3 There are no statutory designated sites located within 500m of land required for the construction of the Proposed Scheme but two that are within 3km are relevant due to their proximity to a proposed construction traffic route. These are:

- Chilterns Beechwoods SAC – is 1276.5ha in size and comprises nine separate blocks of woodland, which are located throughout the Chilterns. One of these blocks, an area of 70.2ha, is approximately 2.5km south of the land required for the construction of the Proposed Scheme. The western tip of this block, a 50m long section of woodland, is adjacent to the A4010 Little Kimble Hill/Aylesbury Road, which will be used by construction traffic. The site is designated for

semi-natural dry grassland and scrubland on chalk and limestone substrates with beech forests. It is of international value; and

- Ellesborough and Kimble Warrens Site of Special Scientific Interest (SSSI) - the 70.2 ha area of the Chilterns Beechwoods SAC described in this section is also designated as a SSSI for the same habitats as described for the SAC. The same 50m long section will be adjacent to the proposed construction traffic route. The site is of national value.

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

- Grassland at North Lee BNS (15.2ha) – a former agricultural research centre designated for semi-improved neutral grassland. There are approximately 20 disused buildings throughout the grassland. The BNS crosses the boundary between this area and the Dunsmore, Wendover and Halton area (CFA10). The larger part of the BNS is in the Dunsmore, Wendover and Halton area (CFA10), but the smaller northern part of the BNS that is in this area (CFA11) contains a section of the land required for the construction of the Proposed Scheme;
- Aylesbury Sewage Works LWS (10.9ha) – is designated for its variety of bird species and contains pasture, open water and scrub. It is approximately 60m from land that is required for the construction of the Proposed Scheme and 140m east of the proposed Thame Valley viaduct, west of Aylesbury. Approximately 5.7ha of the site is lowland meadow, a local Biodiversity Action Plan (BAP) habitat and a habitat of principal importance as identified in Section 41 of the NERC Act (2006)[29]; and
- River Thame BNS (3.1ha) is next to the Aylesbury Sewage Works LWS and approximately 140m north-east of land required for the construction of the Proposed Scheme. This BNS is designated for its floodplain grassland and riparian[30] habitat, which contain uncommon plant species including flowering rush, fat duckweed, and unbranched bur-reed. The Thame Valley viaduct will cross the River Thame, approximately 130m to the south- west of this site.

Habitats

7.3.5 Habitats which are relevant to this assessment are as follows:

Grasslands

7.3.6 There is both grazed and un-grazed semi-natural chalk grassland within the Ellesborough and Kimble Warrens SSSI (which is also part of the Chilterns Beechwoods SAC). Some areas of grassland are species-rich and contain both local and national rarities although some areas are declining in quality owning to scrub encroachment. Although the site was not surveyed, the habitat is a principal reason for the site's designation and the site is of international value.

[29] Natural Environment and Rural Communities Act 2006 (Chapter 16), London. Her Majesty's Stationery Office.
[30] The riparian area is the interface between a watercourse and land. It includes the bank profile and associated terrestrial and emergent vegetation.

7.3.7 The Grassland at North Lee BNS was not surveyed due to lack of access but is likely to be predominantly unmanaged semi-improved neutral grassland. As this is the principal reason for the site's designation, it is of county/metropolitan value.

7.3.8 The damp neutral lowland meadow in the Aylesbury Sewage Works LWS is likely to be grazed and meet the criteria to be a habitat of principal importance and a local BAP habitat. On its own it is considered of up to district/borough value.

7.3.9 In addition there are five blocks of semi-improved neutral grassland within the land required for the construction of the Proposed Scheme; at Stoke House Farm, Whitethorn Farm, land north of Hartwell House, Aylesbury Park Golf Club and Putlowes Farm. Each area is of local/parish value.

Woodland

7.3.10 The mature woodlands are mainly of beech and sycamore with ash. The mixed broadleaved woodland within Ellesborough and Kimble Warrens SSSI (which is also part of the Chilterns Beechwoods SAC) is mainly beech and ash with oak Norway maple, horse chestnut and occasional Scot's pine. The understory has dense box (here thought to be native) and the ground flora has ancient woodland[31] indicator species including spurge laurel, dogs-mercury and enchanters nightshade (but it is not ancient woodland). There is also abundant deadwood and open spaces. Sycamore is regenerating rapidly but as the habitat is a principal reason for the SSSI and SAC designation, it is considered to be of international value.

7.3.11 There are several linear strips of lowland mixed deciduous woodland at Hartwell House, some of which fall within land required for the construction of the Proposed Scheme. The canopy layer comprises ash, sycamore, Scot's pine, beech and oak and the shrub-layer hazel and elder with ground flora including common nettle, ground ivy and wood brome. Parts of the woodland can be characterised as a habitat of principal importance and a local BAP habitat.

7.3.12 There are also several small isolated patches of plantation broadleaved woodland throughout the Aylesbury Park Golf Club. Typical canopy species include densely planted wild cherry and ash, and the approximate age of the plantation is between 15 - 20 years. The Proposed Scheme will also cross a 30m wide linear wooded feature that extends north from the Fleet Marston Spinney. It consists of a patchwork of dense and sparse ash trees with occasional oak. Each of these woodlands is of local/parish value.

Watercourses

7.3.13 The River Thame, the Stoke Brook, other local brooks (including tributaries), and several drainage ditches are crossed by the land required for the construction of the Proposed Scheme.

[31] Woodland that has existed continuously since 1600 or before in England.

7.3.14 The River Thame is approximately 7m wide and meanders through the area. It is not heavily shaded and has a good diversity of aquatic plant species. It qualifies as habitat of principal importance (river as it has vegetation indicative of fast flowing streams (Callitricho-Batrachion vegetation). The Stoke Brook has been straightened and deepened at the points where it will be crossed by the route, but is showing some signs of recovery. These two watercourses are each of district/borough value.

7.3.15 Bear Brook, Sedrup Ditch, Hartwell Ditch, Lower Hartwell Ditch, the Fleet Marston Brook and tributaries, and several drainage ditches have been heavily modified (straightened or over-deepened), and support little plant or animal diversity. In combination, these watercourses are of local/parish value.

Hedgerows

7.3.16 There are approximately 33km of hedgerow in the land required for the construction of the Proposed Scheme. Hedgerows in this area are typically dominated by hawthorn and also include frequent elder, field maple and blackthorn. Of those accessible for survey, at least 4km qualify as important hedgerows (under the Hedgerows Regulations 199732), mainly as they contain a diverse range of woody species. As part of the precautionary assessment, it is assumed that further important hedgerows will be found within land that was not surveyed. The proximity of Aylesbury to the north limits the connectivity of the network but the majority of the important hedgerows are concentrated to the south of the A418 Oxford Road. Important hedgerows to the north-west of Aylesbury are less frequent, but the network is more extensive and represents the only habitat connectivity in the arable landscape. In light of this the hedgerow network is of district/borough value.

Orchards

7.3.17 A 9.5ha traditional orchard is adjacent to the Proposed Scheme on the northern boundary of the Dunsmore, Wendover and Halton area (CFA10). A full description of this receptor is provided in CFA10. It is a habitat of principal importance and local BAP habitat, but has few viable trees. It is of district/borough value.

7.3.18 A second smaller orchard is 80m from land required for the construction of the Proposed Scheme at Stoke House. It is 0.1ha and has fewer than 20 trees. It is a habitat of principal importance and local BAP habitat, but due to its small size and limited number of trees is of local/parish value.

[32] The Hedgerows Regulations 1997 (1997 No. 1160), London. Her Majesty's Stationery Office. The Hedgerow Regulations 1997 comprise two criteria for determining whether a hedgerow is important or unimportant: Wildlife and Landscape, and Archaeology and History. The Ecology Chapter and the Technical Appendix for hedgerows refer to the Wildlife and Landscape criteria. Therefore it is likely that there will be differences between the total number of important hedgerows in the Section 7, ecology and Section 6 cultural heritage chapters of this report.

Scrub

7.3.19 Surveys at Aylesbury Park Golf Club recorded a mature scrub community dominated by hawthorn. Ground flora are diverse and include hairy brome, field rose, and three-nerved sandwort. Despite shading from adjacent mature oak trees the stand is open enough to show close affinity to a hawthorn scrub community and qualifies as the NVC[33] W21b Crataegus monogyna-Hedera helix scrub, Mercurialis perennis sub-community. The scrub is likely to qualify as a habitat of principal importance and, given its limited, extent is of local/parish value.

Ponds

7.3.20 There are 29 ponds and wet ditches in or near land required for the construction of the Proposed Scheme. The majority are between Lower Hartwell and Putlowes Farm. Of these, two that are within the Aylesbury Park Golf Course contained good plant and invertebrate diversity but no notable species. The plant and animal species present in the ponds at Putlowes Farm are indicative of poor water quality. Of the 29 ponds, six have great crested newts present and therefore qualify as habitats of principal importance. Ponds are common throughout the Stoke Mandeville and Aylesbury area, have limited plant diversity and are typical of the lowland arable landscape, and are therefore considered to be of local/parish value.

Other habitats

7.3.21 There are areas of open grassland with scattered trees (parkland) at Aylesbury Park Golf Club and at Hartwell House. Arable land is frequent at the northern and southern ends of the area. These habitats are of up to local/parish value.

Protected and/or notable species

7.3.22 A summary of the species relevant to the assessment is provided in Table 9.

Table 9: Protected and/or notable species

Species/species group	Value	Receptor	Baseline and rationale for valuation
Bat	County/ metropolitan	Barbastelle population associated with habitats between Hartwell House and Fleet Marston Spinney	Static detector surveys regularly recorded low levels of activity for this species (a peak count of five passes per night during July and a peak count of one pass at the spinney in June). Activity of this rare species was concentrated at the eastern edge of the Hartwell Lake and around the spinney. The lake, surrounding mature woodland and the spinney are likely to be a foraging habitat for this species. No roosts were recorded during the tree roost surveys that were completed within the Proposed Scheme and an absence of data for any other month further indicates they are unlikely to roost nearby. The closest known roost is over 5km to the north-east but this is connected to this site by the extensive hedgerow network. Barbastelle

[33] NVC is a detailed survey and classification system that is used to compare plant communities with a range of defined community types.

Species/species group	Value	Receptor	Baseline and rationale for valuation
			bats are rare and sparsely distributed and a species of principal importance[34].
	County/ metropolitan	The bat assemblage associated with Hartwell House Estate and land south of the A418 Oxford Road (foraging and commuting). Excluding the barbastelle population	Static monitoring and activity surveys across the site recorded nine species of bat foraging and commuting around the woodland, lake and watercourses. High levels of activity were recorded for common pipistrelle, soprano pipistrelle, Leisler's bat, noctule, serotine and *Myotis* species (showing call characteristics that indicate a high probability they are Daubenton's bat). Low levels of activity were also recorded for brown long-eared bat and Nathusius's pipistrelle and other *Myotis* species. Soprano pipistrelle, notucle and brown long-eared bat are all species of principal importance. The lake and woodland are important foraging sites and the avenues of trees and woodland edges are important as commuting corridors. They help support the abundance and range of bat species, as well as contributing to the viability of the assemblage. Surveys recorded a single *Myotis* bat (again likely to be a Daubenton's bat) emerging from a tree roost south of the A418 Oxford Road. Three brown long-eared bat summer/transient roosts were recorded during field surveys. These roosts all supported single individuals. The three roosts are outside the Proposed Scheme. Desk study results indicated the buildings on the Estate, support roosting bats and several mature trees, which are all outside the land required for the construction of the Proposed Scheme, have high potential to support roosting bats.
	County/ metropolitan	Brown long-eared bat population west of Stoke Mandeville	A roost with over 1,000 brown long-eared bat droppings was recorded in a building west of Stoke Mandeville (approximately 100m from the Proposed Scheme). The evidence indicates that it is a maternity roost. Maternity roosts are uncommon and necessary to maintain populations over wide areas. Another smaller summer/transient roost (with one bat) was recorded in a second building 50m from the first, approximately 150m from the land required for the construction of the Proposed Scheme. Given the proximity of these roosts, they are likely to be part of the same population. No important commuting routes or foraging sites were recorded but due to the proximity of Stoke Mandeville to the north, they are likely to use the Stoke Brook and the hedgerow network to the south to access the wider landscape, The brown long-eared bat is common and widespread in the UK, with population numbers greater than 100,000[35] but a maternity roost meets the threshold for being of county importance.
	District/borough	*Myotis* species population west of Stoke Mandeville	A summer/transient roost with one bat (likely to be a Daubenton's bat) was recorded approximately 150m from the Proposed Scheme (in the same building as the brown long-eared bat maternity roost described). Low numbers of *Myotis* species were recorded commuting along the Stoke Brook that

[34] Natural Environment and Rural Communities Act 2006 (Chapter 16), London. Her Majesty's Stationery Office.
[35] Bat Conservation Trust (2012). *The state of the UK's bats: National bat Monitoring Programme Population Trends 2012*. BCT, London.

Species/species group	Value	Receptor	Baseline and rationale for valuation
			flows past the roost. *Myotis* species are generally uncommon.
	District/borough	Bat assemblage associated with foraging habitat and commuting routes between Putlowes Farm and Fleet Marston Spinney	Static monitoring surveys recorded moderate to high activity levels of common pipistrelle and soprano pipistrelle at, and between these sites, and comparatively (for this species) high levels of activity of Leisler's bats at the farm, and noctules at the spinney. Less common species such as Nathusius's pipistrelle, Daubenton's bat, Natterer's bat, whiskered/Brandt's bats and *Myotis* species were also recorded at lower levels of activity, and there was the occasional pass of a serotine bat. All bats were recorded commuting and foraging along the hedgerow network and watercourses that lead to the River Thame to the south of the land required for the construction of the Proposed Scheme and several areas of woodland to the west.
	District/borough	Bat assemblage associated with the Stoke Brook to the south of Stoke Mandeville	Common and soprano pipistrelle, *Myotis* species, noctule and serotine were recorded in low to moderate numbers. Most records were along the Stoke Brook, which was used for both foraging and as a commuting route. This watercourse links with the orchard within CFA 10, a known foraging site to the south. A single common pipistrelle was recorded in a tree roost within the land required for the construction of the Proposed Scheme. A residential building 150m north of land required for the construction of the Proposed Scheme had a small number of common pipistrelle bats roosting (less than five). Both roosts are likely to be summer/transient roosts.
Reptiles	County/ metropolitan	Adder population in habitats associated with the Aylesbury Park Golf Club	No adder were recorded during refugia surveys but one was recorded within Aylesbury Park Golf Club during other ecology surveys. The desk study identified two records of adder close to the golf course. Local land managers report adders to be locally common near Lower Hartwell and Aylesbury Park Golf Club, which suggests there is a small population present. As adders are scarce in Buckinghamshire and a species of principal importance, any sustainable population could meet the criteria for being of county importance.
	Up to county/ metropolitan	Grass snake population in habitats associated with the Aylesbury Park Golf Club	Grass snake were recorded throughout the golf course. Field surveys at five locations within the golf course recorded three peak counts of ten individuals, one peak count of three individuals and a peak count of one individual. Given the distance between where the peak counts were recorded and the abundance of suitable habitat for this species throughout the site the population is likely to be at least 30 individuals (a high population). Grass snake are a species of principal importance.
	Local/parish	Grass snake population in between the A41 and Upper Cranwell Farm	Field surveys recorded a peak count of two individuals. The desk study identified no records of reptiles in this area. Habitat within the Stoke Mandeville to Aylesbury area is generally considered to be of low suitability (with the exception of Aylesbury Park Golf Club) to support reptiles, as it largely comprises arable farmland.
Birds	County /	Barn owl breeding	Three barn owl nests were recorded within 1.5km from the

Species/species group	Value	Receptor	Baseline and rationale for valuation
	metropolitan	territories south of Aylesbury	alignment of the Proposed Scheme. This is more than 1% of the county population[36].
	County/ metropolitan	Barn owl breeding territories west of Aylesbury	Four barn owl nests were recorded close to one another within 1.5km o from the alignment of the Proposed Scheme. . This is more than 1% of the county population.
	County/ metropolitan	Barn owl breeding territories north-west of Aylesbury	Four barn owl nests were recorded within 1.5km from the alignment of the Proposed Scheme. This is more than 1% of the county population. Many alternative nesting sites were also recorded.
	County/ metropolitan	Breeding yellow wagtail associated with habitats south of Aylesbury	Field surveys recorded yellow wagtail (two breeding territories). This is of county importance as it represents more than 1% of the county population.
	County/ metropolitan	Breeding yellow wagtail associated with habitat north-west of Aylesbury	Field surveys recorded yellow wagtail (three breeding territories). Yellow wagtail is rare in Buckinghamshire and this population is more than 1% of the county population.
	County/ metropolitan	Breeding raven associated with habitat west of Aylesbury	Field surveys recorded breeding raven (one territory) . This population is of county importance as it is more than 1% of the county population).
	County/ metropolitan	Breeding corn bunting associated with habitat north-west of Aylesbury	Field surveys recorded corn bunting (one territory). Corn bunting are rare in Buckinghamshire and this nesting pair represents more than 1% of the county population.
	County/ metropolitan	Breeding grey partridge associated with habitat north-west of Aylesbury	Field surveys recorded grey partridge (four territories). Grey partridge is rare in Buckinghamshire and this population represents more than 1% of the county population.
	District/borough	Breeding kingfisher associated with habitat north-west of Aylesbury	Field surveys recorded kingfisher (one territory). This pair alone does not exceed 1% of the county population but kingfishers have a restricted distribution within Buckinghamshire and specific habitat requirements.
	District/borough	Breeding red kite associated with habitats south of Aylesbury	Field surveys recorded breeding red kite (three nests). Red kites have a restricted distribution, specific habitat requirements within Buckinghamshire.
	District/borough	Breeding red kite associated with habitats west of Aylesbury	Field surveys recorded breeding red kite (three nests). Red kites have a restricted distribution, specific habitat requirements within Buckinghamshire.

[36] Jackson, P. (2012), The Barn Owl in Northamptonshire 2012. Stoke Bruerne.

Species/species group	Value	Receptor	Baseline and rationale for valuation
	Local/parish	Breeding bird assemblage associated with habitats north-west of Aylesbury	Field surveys recorded 72 bird species within this area. Desk study records also include curlew, a species of principal importance, and as part of the precautionary assessment it is assumed these birds are not breeding. Grey partridge, corn bunting, kingfisher, barn owl and yellow wagtail are all part of this assemblage but are assessed separately.
	Local/parish	Breeding bird assemblage associated with habitats west of Aylesbury	Field surveys recorded 77 bird species within this area. This included the notable species little egret and kingfisher (non-breeding). Desk study records also include goshawk, however, habitat is unsuitable for this species to breed in this area (woodland is scarce). Red kite, raven, yellow wagtail and barn owl are all part of this assemblage but are assessed separately.
	Local/parish	Breeding birds associated with habitats south of Stoke Mandeville	Field survey recorded 59 bird species within this area. Notable species recorded were lapwing (one territory) and kestrel breeding (one territory). Desk study records also include shoveler, pochard, oystercatcher, Cetti's warbler, redshank, marsh tit (a species of principal importance) and cuckoo, however, it cannot be confirmed if these species breed. Other records were for common and widespread breeding bird species typical of open countryside and woodland.
	Local/parish	Breeding bird assemblage associated with habitats south of Aylesbury	Field surveys recorded 62 bird species in this area. Records were for common and widespread breeding bird species and numbers were low typical of open countryside. Yellow wagtail and red kite are part of this assemblage but are assessed as separately.
	Local/parish	Wintering birds at Stoke Mandeville to Aylesbury	Field surveys recorded 57 bird species in this area. Notable species recorded were wintering short-eared owl, wigeon, kingfisher, red kite and grey partridge (a species of principal importance). Desk study records also include lesser spotted woodpecker, bittern, barn owl and merlin. Other records were for common and widespread wintering bird species typical of open countryside and woodland.
Amphibians	County/ metropolitan	Great crested newt metapopulation at Aylesbury Park Golf Club	Field surveys recorded a medium population size class, spread across six breeding ponds comprising three ponds which had low populations and three with medium populations. The ponds are surrounded by rank grassland and woodland, optimum terrestrial habitat for this species, but the rest of the golf course is less suitable. The peak nightly count (for all six ponds) exceeds 40 individuals, which together form a metapopulation[37]. This population size class is of county importance[38]. Great crested newt are a species of principal importance.
	District/borough	Great crested newt metapopulation at Putlowes Farm	Three ponds within farmland each supported a small population size class. With the exception of an area of semi-improved grassland near Fleet Marston, which provides suitable habitat for great crested newts, the terrestrial habitat in the north of this area is generally of low suitability for this species.

[37] A set of local populations within some larger area, where typically migration from one local population to at least some other patches is possible.
[38] Buckinghamshire and Milton Keynes Environmental Records Centre (2009), *Criteria for the Selection of Local Wildlife Site in Berkshire, Buckinghamshire and Oxfordshire.*

Species/species group	Value	Receptor	Baseline and rationale for valuation
	District/borough	Great crested newt population north of Sheepcote Hill Farm	A small population size class (peak count of 9) was recorded in a single pond. Surrounding habitat is poor for this species and there is little connection with the breeding population at Putlowes Farm (approximately 700m to the east). It is therefore likely to be an isolated population.
Terrestrial invertebrates	County/ metropolitan	Invertebrate assemblage associated with habitats within the Aylesbury park Golf Club	Surveys covered areas of grassland, pools and some mature trees. A single Red Data Book[39] species associated with riparian[40] sand, *Polistichus connexus* (a ground beetle), was found within Aylesbury Park Golf Club. Nine Nationally Scarce[41] species variously associated with wood decay, mineral marsh and open water, grassland and scrub matrix and unshaded successional grassland were also found within Aylesbury Park Golf Club. The assemblage meets the criteria for being of county importance[42].
Otter	District/borough	Otter population along the River Thame, Sedrup Brook (and tributaries including Sedrup Ditch)	Field surveys to the south-east of Upper Hartwell recorded two potential otter holts approximately 200m and 300m from land required for the construction of the Proposed Scheme. A spraint was also recorded within land required for the construction of the Proposed Scheme at the Orchard on the B4009 Nash Lee Road (see CFA10). Two spraints were also found along Bear Brook approximately 340m from land required for the construction of the Proposed Scheme. The desk study found only one otter record, from the River Thame in 1998, and this record was over 500m from land required for the construction of the Proposed Scheme, south of Eythrope Park. Otter are a species of principal importance. No breeding holts were recorded; as such the population is unlikely to meet the threshold for county/metropolitan importance38.
Plants	District/borough	Black Poplar throughout the area	Field surveys recorded 18 native black poplar at Stoke Brook, Sedrup Farm, Sedrup Brook, Aylesbury Park Golf Club, Stoke House Farm, Mill House Farm, Putlowes Farm and a field north-east of Upper Cranwell. Desk study records indicate at least another 25 trees in this area. Native black poplars are rare[43]. However, this area is in the UK stronghold for this tree and numbers here are unlikely to be greater than 1% of the Aylesbury Vale population.
Aquatic invertebrates	District/borough	Invertebrate assemblage of the River Thame	Field surveys of the River Thame recorded a Nationally Scarce water beetle *Peltodytes caesus* (*Haliplidae*). Three specimens were collected in two samples suggesting an established population. Usually confined to lowland rich fen pools and ditches, it is unusual to find it in a river. The slow flow of the River Thame is likely to be an important factor in its presence.
	Local/parish	Invertebrate	Field surveys of the Stoke Brook and the Lower Hartwell Ditch

[39] Red data book: red data book system places species into a number of categories based on conservation threat. These range from extinct to near threatened. The latest red data book status for all UK species is published by the JNCC (2011). Taxon designations spreadsheet. Available online at: http://jncc.defra.gov.uk/page-3408 (accessed 19th September 2013).
[40] The riparian area is the interface between a watercourse and land. It includes the bank profile and associated terrestrial and emergent vegetation.
[41] Nationally scarce refers to invertebrates that are recorded in 16-100 hectads (10km squares) but not included in one of the Red List Categories.
[42] Colin Plant Associates (2006), *Invertebrates and Ecological Assessment*. Unpublished Report to the Institute of Ecology and Environmental Management.
[43] Forestry Commission. Information on the conservation of Black Poplar Populus nigra L. Available online at: http://www.forestry.gov.uk/pdf/fcin057.pdf/$FILE/fcin057.pdf (Visited September 2013).

Species/species group	Value	Receptor	Baseline and rationale for valuation
		assemblage of the Stoke Brook and tributaries	lacked any notable species, or species of conservation concern.
	Local/parish	In ponds throughout this area	Field surveys of the ponds lacked any notable species, or species of conservation concern.
Fish	District/borough	Fish population assemblage of the River Thame	Field surveys recorded the presence of low numbers of common species, including spined stickleback, bullhead, common bream, minnow, perch, pike, roach and stone loach in the River Thame.
	Local/parish	Fish population assemblage of the Stoke Brook and tributaries	Field surveys identified the presence of low numbers of bullhead and spined stickleback in the Stoke Brook, the Lower Hartwell Ditch and the Fleet Marston Brook.
Badger	Local/parish	Badger populations throughout this area.	Field surveys identified four main setts (and several additional associated setts) within, or in close proximity to, the land required for the construction of the Proposed Scheme. Bait marking surveys were undertaken at two locations and identified four likely territories. Desk based records suggest badgers are present throughout the area. Suitable habitat is widespread in the wider countryside. Badgers are common and widespread animals in lowland habitats within the UK, and populations are not threatened or thought to be vulnerable at present.
Water vole	Negligible	Stoke Brook, River Thame, Sedrup Ditch and Bear Brook	As most watercourses in this area are suitable for water vole, all or parts of them were surveyed. Field surveys recorded no evidence of water voles. There are very few historical records close to the land required for the construction of the Proposed Scheme. Mink, a known predator of water voles, is present on the River Thame and this may explain the absence of water voles. Given the above, water vole are likely to be absent.
Hazel dormouse	Negligible	Throughout the area	No dormice were recorded during field surveys and there were no records in this area from the desk study. Whilst there are desk study records for dormice in woodland within the Dunsmore, Wendover and Halton area (CFA10) and the Waddesdon and Quainton area (CFA 12) only isolated areas of woodland and scrub are present in the centre of this area, and connectivity to other suitable habitat is poor, with Aylesbury acting as a significant barrier to the north.
White-clawed crayfish	Negligible	Stoke Brook, River Thame and Sedrup Ditch	No white-clawed crayfish were recorded during field surveys. Signal crayfish[44] were recorded in Stoke Brook, River Thame and Sedrup Ditch, confirming the findings of the desk study, and many other watercourses were seasonal and therefore unsuitable.

[44] A non-native invasive species that out-competes native white-clawed crayfish and also carries crayfish plague.

Future baseline

Construction (2017)

7.3.23 A summary of the known developments which are assumed to be mostly built and occupied prior to construction of the Proposed Scheme is provided in Section 2.1, with further details provided in Volume 5: Appendix CT-004-000.

7.3.24 Little ecological change is expected following the construction of The Berryfields MDA (195ha), to the north-west edge of Aylesbury, as the proposed development mainly affects arable fields. There will be only localised temporary effects on fauna. Small areas of new habitat will be created including woodland, wet woodland, wet grassland, wildflower meadow, reedbed and ponds, but they are unlikely to change the baseline value significantly.

Operation (2026)

7.3.25 There are no known committed developments or changes to management in this area that will affect the operational ecological baseline, beyond those described in relation to the construction baseline.

7.3.26 Otter populations are increasing due to water quality improvements in river basins and other factors. Their range is expected to increase throughout this area of the Proposed Scheme by the time of operation.

7.4 Effects arising during construction

Avoidance and mitigation measures

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

- the design of the Thame Valley viaduct avoids the need for footings within the River Thame and therefore reduces possible impacts on the riparian habitat; and
- all culverts will be suitably designed, to allow passage for mammals such as badger, otter and water vole, taking into account flood events, or an alternative dry tunnel will be installed.

7.4.2 The assessment also assumes implementation of the measures set out within the draft CoCP (Volume 5: Appendix CT-003-000) that includes translocation of protected species where appropriate.

Assessment of impacts and effects

Designated sites

7.4.3 Construction of the A4010 Stoke Mandeville bypass will affect the Grassland at North Lee BNS. The integrity of the BNS is partly dependent on the retention of neutral semi-improved grassland, for which the site is designated. Construction will remove approximately 2.1ha (14%) of the grassland, of this 1.3ha (9%) will be permanently removed and 0.8ha (5%) will be used as a satellite compound during construction. The retained areas will be fragmented with a 0.25ha section isolated from the remaining 12.8ha of grassland to the south. Due to its small size and isolation, the nature conservation value of the smallest remnant is likely to decline. Loss of habitat of this extent and the isolation of a smallest fragment will result in a permanent adverse effect on the integrity of the North Lees BNS that is significant at the county/metropolitan level.

7.4.4 No significant impacts are expected on the integrity of Ellesborough and Kimble Warrens SSSI, which is also part of the Chilterns Beechwoods SAC. Habitat within approximately 40m of the A4010 (less than 0.1% of the SAC) is likely to be subject to increases in NOx concentrations that are 1-3% of the critical load[45]. In the worst case scenario, a 3% increase of the critical load represents a small change, below which any effects will be reversible. Any changes in air quality will be for the duration of the construction period only. Possible nitrogen and acid deposition rates may also be subject to very small increases (equivalent to less than 1% of the critical load) and therefore negligible. No long-term build up in deposition or measurable changes in the plant species-richness or abundance are expected. Any such minor effects will therefore be reversible and are unlikely to be significant.

7.4.5 No significant impacts are expected on the integrity of the Aylesbury Sewage Works LWS and the River Thame BNS, as both are approximately 140m upstream of the Thame Valley viaduct construction works and will not be subject to any likely significant effects.

Habitats

7.4.6 Hedgerows will be affected during construction, particularly the extensive network around Putlowes Farm and the important hedgerows south of Stoke Mandeville. The proportion and extent of important hedgerows are integral to the conservation status of this habitat, as is the continuity of the network as a system of wildlife corridors. During construction at least 4km of important hedgerows will be removed, mainly at the Aylesbury South embankment and the Oxford Road South embankment construction sites.

[45] Critical Loads are defined as: a quantitative estimate of exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge (Source: APIS (Undated). *Critical Loads and Critical levels - a guide to the data provided in APIS* [on-line] http://www.apis.ac.uk/overview/issues/overview_Cloadslevels.htm (accessed 15.10.2013).

7.4.7 The loss of hedgerows, particularly south of Putlowes Farm, will fragment the network in an area where it provides the only connectivity across the arable landscape. Loss and fragmentation of this extent will result in a permanent adverse effect on the conservation status of hedgerows that is significant at the district/borough level.

7.4.8 It is considered unlikely that any other effects on habitat receptors at more than the local/parish level will occur. This includes the River Thame and the Stoke Brook because of the small extent that will be affected in relation to the size of the watercourses and the abundance of similar habitat in the wider landscape. The retention of over 13ha of semi-improved neutral grassland within the Grassland at North Lee BNS will help avoid any significant effects on the conservation status of this habitat. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-002.

Species

7.4.9 The removal or disturbance of habitat features that are utilised by bats during breeding, hibernation or migrating between roosts are considered to have the potential to result in adverse effects on the bat populations or assemblages during construction. However, the point at which such impacts are considered likely to result in a significant adverse effect on the conservation status of the population concerned will differ dependent on the status of the species concerned.

7.4.10 Construction will affect one potential brown long-eared maternity roost, west of Stoke Mandeville. Bats depend on maternity roosts to rear young and for shelter and protection and the extent of continuity of linear vegetation for communing and foraging. The roost is approximately 100m to the north-east of the land required for the construction of the Proposed Scheme so will not be directly lost. The construction of the Aylesbury south cutting will remove hedgerows to the south-west of the roost, which this breeding population is likely to use when moving through the landscape and for foraging. The footprint of the Aylesbury south cutting will be approximately 200m wide and its construction will sever the hedgerow network within it. While the reduction in available hedgerow length as a foraging resource is in itself unlikely to be significant, brown long-eared bats are susceptible to the effects of fragmentation and therefore some bats would not cross a gap this wide. Vegetation clearance could isolate the roost within a block of arable land between Aylesbury, Stoke Mandeville and the construction works. The extent of isolation may result in a permanent adverse effect on the conservation status of brown long-eared bats that would be significant at the county/metropolitan level.

7.4.11 Losses of other habitat within the land required for the construction of the Proposed Scheme may require some bats to travel further, and expend more energy during day to day foraging and movement throughout their home range for the duration of construction. However, such effects alone are for all species considered unlikely to result in sufficient disturbance of the populations concerned to result in an adverse effect on their conservation status.

7.4.12 No significant effects on the conservation status of the barbastelle population utilising habitats between Hartwell House and Fleet Marston Spinney are expected. It is unlikely that any roosts will be affected and the important foraging habitat at Hartwell and Fleet Marston will be retained. With the proximity of Aylesbury to the north, no important north-south movements are likely to be severed.

7.4.13 No significant impacts are expected on the bat assemblage associated with Hartwell House and the surrounding estate. The loss of a single pipistrelle bat tree roost and the reduction in movement northwards towards Aylesbury Park Golf Club are unlikely to adversely affect the conservation status of the bat assemblages in the area. The principal roosting, foraging and commuting routes will be retained.

7.4.14 The abundance of hedgerows and watercourses that will be retained around the Proposed Scheme will reduce the effects of habitat loss by maintaining areas of available foraging habitat as important commuting routes. No other bat populations are therefore likely to be subject to significant adverse effects.

7.4.15 Construction of the Oxford Road south embankment, the Oxford Road north embankment and the Thame Valley viaduct cutting will affect adders, within and near the Aylesbury Park Golf Club. The extent and continuity of foraging and sheltering habitat is important to the conservation status of a viable population. Construction will occupy over 40ha of land and remove much of the rank grassland and scrub from this site (approximately 11ha of terrestrial habitat suitable for adder). It is possible that this population's entire range could be removed thus removing the species from the area. As a rare species in Buckinghamshire, a loss of this extent will result in a permanent adverse effect on the conservation status of adder that will be significant at the county/metropolitan level.

7.4.16 The high population of grass snake (likely to be at least 30 individuals) that inhabit the Aylesbury Park Golf Club will be affected by the same impacts as described for adder. The loss of foraging sites, habitat features used for shelter and breeding and continuity between riparian habitat, grassland and scrub is likely to reduce the extent of habitat available for this species below that for which a sustainable population will remain viable. This will result in a permanent adverse effect on the conservation status of grass snake that is significant at up to a county/metropolitan level.

7.4.17 Barn owl breeding territories may be affected during construction. Nesting sites are re-used annually and are therefore important to the maintenance and conservation status of this species. Three nests will be removed from land required for the construction of the Proposed Scheme (two nest sites to the west of Aylesbury and one nest site to the north-west of Aylesbury) and at least 70ha of likely foraging habitat (associated with the three nests) will be lost. The pair that nests to the north-west of Aylesbury has alternative nesting opportunities nearby, but all these alternative sites are close to the Proposed Scheme and are likely to be subject to frequent disturbance during construction. It has therefore been assumed that they would be lost. The loss of this small population, of a species which is in decline, will result in a permanent adverse effect on the conservation status that is significant at the county/metropolitan level.

7.4.18 Two further barn owl nests which are located north west of Aylesbury, may be separated from their foraging habitat by the construction works. However, the width of the construction corridor is limited to 35m, which is unlikely to cause a significant barrier to movement, thus this breeding pair is unlikely to be significantly affected.

7.4.19 With the implementation of the draft CoCP the loss of habitat and increased disturbances (light, noise and movement) during construction are unlikely to adversely affect the conservation status of red kite, raven, corn bunting, yellow wagtail, kingfisher and the general breeding bird assemblages present, due to an abundance of alternative and suitable nesting and foraging habitat throughout the wider landscape and the temporary (up to four years) nature of the construction works.

7.4.20 The Proposed Scheme will affect a medium sized class metapopulation of great crested newt, across six ponds within and near to the Aylesbury Park Golf Club. Maintaining the number of breeding ponds within a network of suitable grassland and scrub for foraging and hibernating is important to the conservation status of this species. The construction of the Oxford Road north embankment and the Thame Valley viaduct southern approach embankment will result in the permanent loss of five of the six ponds supporting the medium sized metapopulation. At least nine other ponds that do not support great crested newt, but which are suitable, will also be lost. Construction will occupy over 40ha of land, and remove much of the rank grassland and scrub (approximately 11ha) from the site. The loss of these breeding ponds and large areas of suitable terrestrial habitat will result in a permanent adverse effect on conservation status of the great crested newt metapopulation that is significant at the county/metropolitan level.

7.4.21 A small great crested newt metapopulation across three breeding ponds will be affected near Putlowes Farm during the construction of the Thame Valley viaduct north cutting and the Bicester Road embankment. One of the three ponds will be removed and the two remaining breeding ponds will be separated from one another by a construction corridor approximately 250m wide. Little optimal terrestrial habitat will be removed, as the land required for the construction of the Proposed Scheme is dominated by large arable fields. The loss of the breeding pond will affect the viability of this breeding population, and due to the small numbers recorded in the retained ponds, fragmentation for up to three years may result in reduced genetic diversity. These impacts are likely to result in a permanent adverse effect on the conservation status of this great crested newt population that is significant at the district/borough level.

7.4.22 No impacts above those at the local/parish level are anticipated on the small great crested newt population north of Sheepcote Hill Farm.

7.4.23 The Proposed Scheme will affect the invertebrate assemblage within Aylesbury Park Golf Club. The provision and continuity between uncommon habitat features such as dead wood, a mosaic of grassland and scrub; flowing water; and open water are important in maintaining conservation status of this invertebrate population. The construction of the Oxford Road south embankment to the Thame Valley viaduct southern approach embankment will occupy an area of over 40ha, which will include

approximately 2ha of wetland and open water and much of the grassland, scrub and deadwood habitat within Aylesbury Park Golf Club. This is likely to reduce the features and resource required by this assemblage to maintain a viable population. Loss of habitat of this extent will result in a permanent adverse effect on the conservation status of the assemblage, which includes red data book invertebrates. It will be significant at the county/metropolitan level.

7.4.24 No significant effects are expected on the otter population. No breeding holts are likely to be removed, and there is suitable habitat for foraging along watercourses in the surrounding area (particularly the Bear Brook). Access for otter will be retained along the watercourses (as described previously). The temporary severance of the southern reaches of Stoke Brook, south of Stoke Mandeville, are unlikely to be significant as this branch of the brook is fed by nearby springs. Habitat suitable for otter that will be temporarily removed is therefore kept to a minimum.

7.4.25 It is considered unlikely that any other effects on species receptors at more than the local/parish level will occur. Effects at the local/parish level are listed in Appendix EC-005-002 in Volume 5.

Other mitigation measures

7.4.26 This section describes additional measures designed to reduce or compensate for significant ecological effects. These include habitat creation and habitat enhancement and will be undertaken in line with the principles of mitigation (Appendix 5: CT-001-000/2).

7.4.27 Eight ecological compensation areas have been incorporated into the land required for construction of the Proposed Scheme, these are:

- land north of the orchard to the north of Nash Lee Road (approximately 1.3ha), which will contain grassland with trees (and may also contain scrub and ponds);
- land west of the realigned section of the Stoke Brook (approximately 3ha) which will contain damp grassland with scrub;
- land south-west of Mill House Farm (approximately 2ha) which will contain the habitat of principal importance, lowland meadow;
- land between the Aylesbury Rail overbridge and the Stoke Mandeville bypass (approximately 1ha) which will contain species-rich grassland;
- land south of Oat Close, Aylesbury (approximately 2.5ha) which will contain damp grassland with scrub and ponds;
- land south of Aylesbury Sewage Works LWS (approximately 4ha) which will contain neutral grassland with scrub and ponds;
- land west of Putlowes Farm (approximately 4ha) which will contain damp and neutral grassland; and

- land south-west of Fleet Marston Farm (approximately 4ha) that will comprise two adjacent triangles of damp grassland with scrub, trees and ponds.

7.4.28 In addition, areas of landscape planting and floodplain compensation and any other green infrastructure arising from the Proposed Scheme may provide additional benefits to ecology. In particular the planting of woodland as a visual screen between the route alignment and the Stoke Mandeville bypass, and near Hartwell House is likely to provide additional nesting and foraging habitat.

7.4.29 To compensate for the loss of approximately 2.1ha (14%) of grassland from the Grassland at North Lees BNS new areas of grassland will be created either side of the A4010 Stoke Mandeville bypass and within the ecology compensation area to the south-west of Mill House Farm (150m from the BNS). The newly planted verges of the new A4010 Stoke Mandeville bypass will connect to the BNS and the area of grassland that will be lost during the construction of the Risborough Road satellite compound. This area will be reinstated as semi-improved neutral grassland post-construction. Blocks of semi-improved neutral grassland will also be planted in several of the other ecological compensation areas. Habitat planting and reinstatement will be undertaken in accordance with the principals of mitigation (Volume 5: Appendix CT-001-000/2). Together, these measures will help maintain the conservation status of the remaining grassland and will provide an increase to the area of this habitat.

7.4.30 New hedgerow creation will be undertaken and connected to existing habitat within the landscape to compensate for the losses of wildlife corridors that hedgerows provide. The hedgerow replanting will be in accordance with the principles of mitigation (Appendix 5: CT-001-000/2). The species composition of the new hedges will take account of both the hedgerows lost and those that remain in the surrounding area. The linking of hedgerows to the culverts and overbridges will help provide habitat continuity across the route as well as along it. There will be temporary adverse effects whilst the new hedges become established and mature. Following maturation of the planting it is anticipated that any adverse impacts on hedgerows and the wildlife corridors they provide are expected to be reduced so that effects on conservation status will not be significant.

7.4.31 Bat roosts to compensate for the loss of the brown long-eared maternity roost, will be provided in accordance with the principles of mitigation (Volume 5: Appendix CT-001-000/2). The roosts will be created in either the land to the north of the orchard (north of the B4009 Nash Lee Road) ecological compensation area or within or near the Hartwell House Estate. The compensatory roosts will be created prior to the loss of habitat. Following the implementation of the measures proposed it is anticipated that any adverse impacts on bats during construction of the Proposed Scheme will be reduced so the effects on their conservation status will not be significant.

7.4.32 Although no significant effects are expected to bats recorded in other parts of the area, new roosts will be created within and near the Hartwell House Estate, to compensate for the loss of the tree roosts (both the confirmed pipistrelle roost and any trees that have potential to support roosting bats). Additional new roosts may be created in several of the ecological compensation areas and within the landscape

planting. These measures will help maintain will maintain the conservation status of the bat species and assemblages in this area.

7.4.33 To compensate for the loss of linear features throughout the area used by bats for commuting and foraging, hedgerows will be planted as described. Linkages across the Proposed Scheme will be provided by planting the embankments of overbridges and linking wide culverts to retained habitat; particularly the Footpath ELL/20 overbridge, Bridleway SBH/19 overbridge, Footpath SBH/27 overbridge Rifle Spinney Culvert and the Footpath SBH/32 overbridge. In addition, to provide a safe crossing over the route and to compensate for the loss of the linear woodland from the northern edge of the A418 Oxford Road, up to 7ha of woodland will be planted along the wide embankments of the new A418 Oxford Road overbridge. Once mature, these measures will encourage bats to fly at a safe height over the Proposed Scheme, or under it. Following the implementation of the measures proposed, it is expected the conservation status of the species and assemblages present will be maintained.

7.4.34 New habitat for adders will be created in the ecological compensation area south of Aylesbury Sewage Works, to replace that lost at Aylesbury Park Golf Course. This 4ha area of grassland with scrub and scattered trees will adjoin the retained northern end of the golf course and therefore the retained suitable habitat. The mitigation area will be created and managed in accordance with the principles of mitigation (Volume 5: Appendix CT-001-000/2). Following the implementation of the measures proposed it is expected that any adverse impacts on the adder during the construction of the Proposed Scheme will be reduced so effects on the conservation status will not be significant.

7.4.35 To compensate for the loss of habitat suitable for grass snake from Aylesbury Park Golf Club, new habitat will be created in several of the ecological compensation areas. Damp grassland with scrub, open water and opportunities for hibernating will be created, principally for the grass snake population, but also other common reptile species. The main sites include land to the west of the realigned section of the Stoke Brook and south of Oat Close, Aylesbury. These are large areas close to and connected to existing water bodies, watercourses and areas of grassland, ideal for grass snake.

7.4.36 The grass snake population at Putlowes Farm will be moved to the adjacent ecological compensation areas, south-west of Fleet Marston Farm. As they will lie adjacent to two watercourses, they will also allow connectivity to suitable habitat in the wider area. Following the implementation of the measures proposed it is expected that any adverse impacts on grass snake during construction will be reduced, so effects on the conservation status will not be significant.

7.4.37 There will be an adverse effect on the conservation status of barn owl at the county/metropolitan level due to loss of three territories. To offset the likely loss of barn owls from the vicinity of the Proposed Scheme, opportunities to provide barn owl nesting boxes in areas greater than 1.5 km from the route will be explored with local landowners. As the availability of nesting sites is a limiting factor for this species the implementation of these measures would be likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.

7.4.38 Compensatory habitat will be provided where breeding ponds and terrestrial habitat of great crested newts are lost. The population at the Aylesbury Park Golf Club will be moved to the 4ha ecological mitigation area to the south of Aylesbury Sewage Works LWS. Additional habitat will be provided within the ecological compensation area between the Aylesbury Rail overbridge and the Stoke Mandeville bypass, if required. The creation of suitable grassland with ponds, scrub and habitat features for hibernation will be provided in accordance with the principles of mitigation (Volume 5: Appendix CT-001-001/2). The new habitats will be sufficient to maintain the favourable conservation status of the population affected.

7.4.39 To compensate for the loss of great crested newt habitat from within and around Putlowes Farm, terrestrial and aquatic habitat suitable for breeding great crested newt will be created (as described for the Aylesbury Park Golf Club population) to the west of Putlowes Farm. This compensation site will be within 200m of the two retained breeding ponds. It will also increase the extent of suitable habitat that is close to the isolated population at Sheepcote Hill Farm. Great crested newts could also be moved to the ecological compensation area to the south-west of Fleet Marston Farm, which would maintain habitat continuity with the retained breeding population to the east of the route at Putlowes. Habitat creation of this extent will retain and enhance the species conservation status and as such there will be no significant ecological effects to great crested newt.

7.4.40 Several of the ecological compensation areas will be designed to compensate for the loss of habitat supporting an important invertebrate assemblage at Aylesbury Park Golf Club. The damp grassland south of Oat Close, Aylesbury, and the land to the south of Aylesbury Sewage Works LWS be designed and managed in accordance with the principles of mitigation (Appendix 5: CT-001-000/2). A similar mosaic of habitats will be created in the other ecological compensation areas within this area, thus further increasing the extent of available habitat. Habitat creation of this extent will retain and enhance the conservation status of these invertebrate species and as such there will be no significant ecological effects.

7.4.41 Where reasonably practicable, cuttings will be taken from native black poplar trees that are to be felled and used to propagate and plant new trees throughout the area. This would be particularly appropriate along the re-alignment of the Stoke Brook. This planting will compensate for the loss of this species and as such there will be no significant ecological effects to native black poplar trees.

Summary of likely residual significant effects

7.4.42 The mitigation, compensation and enhancement measures described will reduce the effects to a level that will not be significant, except for the barn owl population. The permanent loss of three barn owl territories represents a residual significant effect. However, if the proposed mitigation measures for barn owl are implemented through liaison with landowners, the residual effect on barn owl would be reduced to a level that is not significant.

7.5 Effects arising from operation

Avoidance and mitigation measures

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

- the creation of planted embankments either side of road, footpath and access crossing points to encourage bats to fly at a safe height over the Proposed Scheme, or under where culverts are present and avoid the Proposed Scheme (particularly at the Nash Lee Orchard footpath overbridge, the Lower Hartwell Public footpath overbridge, and the Cranwell Farm footbridge); and
- the provision of the River Thame viaduct and culverts will encourage bats to fly safely under the Proposed Scheme and reduce the risk of train strike .

Assessment of impacts and effects

7.5.2 The operation of the Proposed Scheme has the potential to result in a variety of impacts on bat populations including those as a result of collision with passing trains, turbulence and noise. The point at which such impacts are considered to result in a significant adverse effect on the conservation status of the populations concerned will differ between species. As a consequence, the following assessment of operational impacts takes into account the differing character and nature of the bat populations and/or assemblages concerned in determining the likely effects of the Proposed Scheme on each of these receptors.

7.5.3 Sound, noise and vibration and lighting from passing trains have the potential to disturb bat species foraging and commuting within habitats close to the Proposed Scheme. Understanding of the impact of noise on bats caused by passing trains is limited. There is some evidence to suggest that gleaning bats, such as brown long-eared, will have reduced foraging success within areas where there is persistent noise from busy roads. However, noise generated from passing trains will be regular but temporary and as such will differ from that resulting from a busy road.

7.5.4 It is unlikely that noise disturbance will adversely affect the brown long-eared bat population west of Stoke Mandeville, as this roost will be removed and relocated during construction.

7.5.5 Due to the large areas over which bats forage it is likely that any loss of, or displacement from, suitable foraging habitat in the vicinity of the Proposed Scheme would in itself amount to only a small proportion of the wider available resource. The avoidance and mitigation measures described above will allow bats to cross the route, and thus help avoid and reduce the risk of fragmentation below a level that would be significant.

7.5.6 Where the route of the Proposed Scheme bisects or is located in close proximity to existing features known to be utilised regularly by foraging or commuting bats, there is an increased risk that bats could be killed or injured as a result of collisions with passing trains or associated turbulence. The significant of any such effect will be dependent on both the flight habitat of the species or species concerned and the vertical alignment of the Proposed Scheme (i.e. is the railway in cutting, embankment, on a viaduct, or at grade) at the point the impact occurs.

7.5.7 The provision of the crossing points (described within the avoidance and mitigation section), will encourage bats to fly at a safe height over the Proposed Scheme or under it, thus reducing the risk of train strike. These measures are likely to be particularly important along known important commuting routes, including; along the Stoke Brook, across the hedgerow network to the south of Aylesbury and along the Lower Hartwell Brook, between the Hartwell House Estate and the Aylesbury Park Golf Club.

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

7.5.9 The majority of bird species that are known to be present in the area are not considered to be particularly vulnerable to collision with trains. However, barn owls are often killed by cars and trains. This is because they hunt low over the rough grassland habitats that are associated with road verges and railway embankments and are slow moving. Evidence suggests that such mortality is likely to result in the loss of all breeding populations of barn owls within 1.5km of the Proposed Scheme.

7.5.10 The land required for the operation of the Proposed Scheme in this area includes wide cuttings and embankments that will be colonised by vegetation that may be suitable for foraging barn owl, and may therefore increase their risk of mortality from contact with trains. It is likely that two breeding pairs south of Aylesbury and two breeding pairs west and north-west of Aylesbury will be isolated between the towns and the route. They will therefore likely cross the route to access the main foraging land to the south and west, thus increasing the risk of train strike. The infrequent but continuous mortality of barn owl will result in a permanent adverse effect on the conservation status of this species at the county/metropolitan level.

7.5.11 It is considered unlikely that any other effects on species receptors at more than the local/parish level will occur. Effects at the local/parish level are listed in Volume 5: Appendix EC-005-002.

Other mitigation measures

7.5.12 This section describes additional elements designed to reduce or compensate for significant ecological effects. These include mitigation measures to discourage species from foraging close to the Proposed Scheme.

7.5.13 Following implementation of the measures proposed it is expected that any adverse impacts on bats as a consequence of the operation of the Proposed Scheme will be reduced to a level at which they will not result in any significant effect on the conservation status of the species concerned.

7.5.14 Train strike is likely to result in the loss of barn owls that nest close to the route. As part of the precautionary assessment it is assumed all territories within close proximity to the route could be lost and therefore adverse effects are likely to remain significant at the county/metropolitan level. To offset these losses opportunities to provide barn owl nesting boxes in areas greater than 1.5km from the route will be explored with local landowners. As the availability of nesting sites is a limiting factor for this species the implementation of these measures would be likely to increase numbers of barn owls within the wider landscape and thus offset the adverse effect.

7.5.15 Mammal fencing will be put in place to guide badgers, otters and other mammals away from the railway line-side to safe crossing points and prevent mortality (Appendix CT-001-000/2).

Summary of likely residual significant effects

7.5.16 The mitigation, compensation and enhancement measures described above reduce the residual ecological effects during operation to a level that will not be significant, except for barn owl. Train strike is likely to result in the loss of barn owls that nest close to the route resulting in a residual significant effect. However, if the proposed mitigation measures for barn owl are implemented through liaison with landowners, the residual effect on barn owl would be reduced to a level that will not be significant as well.

8 Land quality

8.1 Introduction

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

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

8.1.3 The main environmental features of this area include the River Thame and its tributaries including Stoke Brook and Bear Brook, the underlying Portland Stone Principal Aquifer, and Hartwell Estate perimeter walls Local Geological Site (LGS).

8.1.4 The main land quality issues in this area include:

- existing Princes Risborough to Aylesbury Line;
- historical Hartwell clay, brick and tile works;
- historical Hartwell landfill (Map LQ-01-23, E5 (Volume 5, Land quality Map Book)
- potentially in-filled water features along the route; and
- historical sewage works near Lower Hartwell

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

- Appendix CT-001-000/1: the SMR and Appendix CT-001-000/2 the SMR Addendum; and
- Appendix LQ-001-011: Land quality appendix.

8.1.6 Land contamination issues are closely linked with those involving water resources and waste. Issues regarding groundwater resources are addressed in Section 13 Water resources and flood risk assessment. Issues regarding the disposal of waste materials, including contaminated soils, are addressed in Volume 3: Section 16.

8.1.7 Engagement has been undertaken with the Environment Agency, Ministry of Defence, Aylesbury Vale District Council and Wycombe District Council regarding land contamination and Buckinghamshire County Council with regard to mineral policy. Information has been received on mineral extraction, mineral safeguarding areas and land contamination. Information sought has been incorporated where received.

8.2 Scope, assumptions and limitations

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

8.2.2 Baseline data were reviewed for the area of land required to construct the Proposed Scheme, excluding utility works, together with a buffer extending out for a minimum of 250m, but in the case of groundwater data were reviewed up to 1km. This is defined as the study area. With respect to land quality issues, utility works within the highway are a low risk construction activity, as most of the excavation works will be within the highway construction layers and re-instatement will be made with highway construction materials

8.2.3 Familiarisation visits to the study area were made in July 2012 where the location of the Proposed Scheme was viewed from points of public access only. Due to access constraints not all sites considered to have the greatest potential for contamination were visited. However, the purpose of site visits is to verify desktop information and the lack of complete site walkovers is considered unlikely to have substantially affected the land quality assessment.

8.3 Environmental baseline

Existing baseline

8.3.1 Unless otherwise stated, all features described in this section are presented in Maps LQ-001-021b to LQ-001-25a (Volume 5, Land Quality Map Book).

Geology

8.3.2 This section describes the underlying ground conditions within the study area. It first describes any made ground present, followed by near surface superficial deposits and lastly describes the deeper bedrock geology. The geological mapping is illustrated on Map WR-02-011 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

8.3.3 An area of infilled ground is located 160m north-east of the route in the vicinity of Park Villa located to the south west of Aylesbury, where a brickworks was historically located. A cover of made ground may also be present in built up areas of the study area as a result of previous development.

8.3.4 Superficial deposits are absent over the majority of the area with two exceptions. There are River Terrace Deposits, consisting of sands and gravels associated with the River Thame, Stoke Brook, Bear Brook and their tributaries. There are also four small areas of Head deposits, consisting of silt, sand and clay north-east of Standall's Farm, at Lower Hartwell, south of Putlowes, and at Fleet Marston.

8.3.5 Bedrock geology underlying the southern 3.6km of the route comprises the Cretaceous Gault and Upper Greensand Formations, consisting of mudstone, limestone and sandstone which together could be up to 100m thick in this area.

8.3.6 For the proceeding 400m the Purbeck Limestone Group outcrops at the surface, and is described as interbedded limestone and mudstone which is up to 5m thick.

8.3.7 This is followed by the Portland Group (consisting of both the Portland Stone Formation and the Portland Sand Formation), described as limestone and calcareous sandstone for the proceeding 750m extending to the A418 Oxford Road and is up to 15m thick in this area.

8.3.8 Beyond the A418 Oxford Road and extending northwards beyond this route section the bedrock geology comprises the Ancholme Group made up of the West Walton, Ampthill Clay and Kimmeridge Clay Formations, described as mudstone, siltstone and sandstone and together could be up to 125m thick in this area.

Groundwater

8.3.9 The Environment Agency has designated the Portland Stone Formation as a Principal aquifer.

8.3.10 The Portland Sand Formation and Purbeck Limestone have been designated Secondary A aquifers. Both the River Terrace Deposits and the Alluvium have also been designated by the Environment Agency as Secondary A aquifers.

8.3.11 The Gault and Upper Greensand Formations as well as the Ampthill Clay and the Kimmeridge Clay have all been designated as Unproductive.

8.3.12 This route section is not located within a source protection zone.

8.3.13 A search for groundwater abstractions confirmed that there were no records of groundwater abstractions for public water supply (PWS) within 1km of this section of the route.

8.3.14 The Environment Agency reported that there were two licensed abstractions, for non-PWS uses, within 1km of the route. Both licensed abstractions are from wells. One well is located approximately 700m west of the Aylesbury north cutting, just north of Upper Hartwell. The other well is approximately 400m north east of the Thame Valley viaduct cutting, on the western side of Aylesbury.

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

Surface waters

8.3.16 The Proposed Scheme will cross the River Thame just north of Whaddon Hill Farm. There are a number of tributaries including Stoke Brook, and Bear Brook within the study area. There are also a number of drains, small ponds and lakes in the area. There are no surface water abstractions within 1km of the route.

8.3.17 Further information on surface waters is provided in Section 13.

Current and historical land use

8.3.18 Current potentially contaminative land uses include the existing Princes Risborough to Aylesbury Line which crosses the route west of Stoke Mandeville.

8.3.19 Historical potentially contaminative land uses include:

- historical Hartwell clay, brick and tile works;
- historical Hartwell Landfill;
- historical sewage works near Lower Hartwell; and
- potential historically infilled ponds.

8.3.20 Contaminants commonly associated with these land uses could include metals, semi-metals, asbestos, organic and inorganic compounds. Infilled pits could also give rise to landfill gases such as methane, carbon dioxide or volatile organic compounds.

Other regulatory data

8.3.21 Regulatory data reviewed included pollution incidents, radioactive and hazardous substances consents and environmental permits (previously landfill, Integrated Pollution Control (IPC) and Integrated Pollution Prevention and Control (IPPC) licences). No significant data was noted.

Mining/mineral resources

8.3.22 The Buckinghamshire Minerals and Waste Core Strategy DPD (2012), Policy CS1 states that development proposals in this area, other than those involving minerals extraction, will need to demonstrate that they will not sterilise any mineral resources, or that consideration has been given to prior extraction of the protected mineral or that the need for the proposed development outweighs the economic value of the mineral resource. There are no mineral consultation/safeguarding areas as designated by Buckinghamshire County Council within the study area, nor have any preferred mineral sites, current extractions or sites with planning permission been identified.

8.3.23 There are no recorded shallow mines or mineral reserves currently being worked within the study area.

Geo-conservation resources

8.3.24 The Wycombe Delivery and Site Allocation Plan[46] was submitted to the Planning Inspectorate in September 2012 and is expected to be adopted in2013. Policy DM12 states that development which will harm directly or indirectly sites of nature conservation or geological interest or protected species including those shown on the proposals map will only be permitted subject to a number of criteria.

8.3.25 The perimeter walls at the Hartwell Estate have been identified by Buckinghamshire County Council as a LGS as they are constructed of Portland Stone containing the remains of the distinctive large ammonite *Titanites giganteus*. These perimeter walls are located approximately 185m south of the route, following the A418 Oxford Road between Stone and Aylesbury.

Receptors

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

Table 10: Summary of sensitive receptors

Issue	Receptor type	Receptor description	Receptor sensitivity
Land Contamination	People	Residents in existing properties	High
		Workers e.g. industrial facilities and existing railway	Moderate
	Controlled waters	Principal aquifer of the Portland Group	High
		Secondary A aquifer of the Purbeck Limestone	Moderate
		Secondary A aquifer of the River Terrace Deposits and Alluvium	Moderate
		River Thame and tributaries	High
	Built environment	Buildings and property	Low to high
		Underground structures and services	Low

Future baseline

8.3.27 There are currently no identified committed development sites within the study area that are likely to change the land quality baseline during either construction or operation of the Proposed Scheme. The only committed developments are for business, community or residential use and these are unlikely to impact land quality beyond their site boundary.

[46] Wycombe District Council (September 2012), *Wycombe Delivery and Site Allocation Plan*.

8.4 Effects arising during construction

Avoidance and mitigation measures

8.4.1 The construction assessment takes into account the mitigation measures contained within the draft CoCP (see Volume 5: Appendix CT-003-000/1). The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme. Its requirements in relation to work in contaminated areas will ensure the effective management and control of the work. Such requirements include:

- methods to control noise, waste, dust, odour, gasses and vapours (draft CoCP, Sections 5, 7, 13 and 15);
- methods to control spillage and prevent contamination of adjacent areas (draft CoCP, Section 5);
- the management of human exposure for both construction workers and people living and working nearby (draft CoCP, Section 11);
- methods for the storage and handling of excavated materials (both contaminated and uncontaminated) (draft CoCP, Sections 7 and 15);
- management of any unexpected contamination found during construction (draft CoCP, Section 11);
- a post remediation permit to work system (draft CoCP, Section 11);
- storage requirements for hazardous substances such as oil (draft CoCP, Section 16);
- traffic management to ensure that there is a network of designated haul roads to minimise compaction/degradation of soils (draft CoCP, Section 7);
- methods to monitor and manage flood risk and other extreme weather events which may affect land quality during construction (draft CoCP, Section 16); and
- a cap for the nearby landfill area with a secondary area to the south in the form of a reed bed to trap potential contaminants leaching out, to the west of the Proposed Scheme and to the south of the A418 Oxford Road.

8.4.2 The draft CoCP requires that a programme of further desk and site based investigation will take place prior to construction to confirm areas of contamination and that a risk assessment is undertaken to determine what, if any, site specific remediation measures will be required to allow the Proposed Scheme to be constructed safely and to prevent harmful future migration of contaminants (draft CoCP, Section 11)."The investigation and assessment of potentially contaminated sites will be undertaken in accordance with:

- Environment Agency CLR11 Model Procedures for the Management of Land Contamination (2004)[47]; and

[47] Environment Agency (2004), *CLR11 Model Procedures for the Management of Land Contamination*.

- British Standard BS10175 Investigation of Potentially Contaminated Sites (2011)[48].

8.4.3 Where significant contamination is encountered, a remedial options appraisal will be undertaken to define the most appropriate remediation techniques. This appraisal will be undertaken based on multi-criteria attribute analysis that considers environmental, resource, social and economic factors in line with Sustainable Remediation Forum UK's publication A Framework for Assessing the Sustainability of Soil and Groundwater Remediation (2010)[49]. The preferred option will then be developed into a remediation strategy, in consultation with regulatory authorities prior to implementation.

8.4.4 Contaminated soils excavated from the site, wherever feasible, will be treated as necessary to remove or render any contamination inactive and reused within the Proposed Scheme where needed and suitable for use. Techniques are likely to include stabilisation methods, soil washing and bio-remediation to remove oil contaminants. Contaminated soil disposed of off-site will be taken to a soil treatment facility, another construction site (for treatment, as necessary, and reuse) or to an appropriately permitted landfill.

Assessment of impacts and effects

8.4.5 Through this area the Proposed Scheme will run close to existing ground level but will alternate locally between embankment and cutting with the new Thame Valley viaduct located east of Aylesbury where the route crosses over the River Thame.

8.4.6 An express feeder auto-transformer station will be located at Sedrup.

8.4.7 One main construction compound will be created, along with four civil engineering satellite compounds and five railway installation satellite compounds (of which three will continue to use compounds previously established for the civil engineering works). The proposed locations of construction compounds within the area are shown on Maps CT-05-040b to CT-05-047a (Volume 2, CFA11 Map Book).

Land contamination

8.4.8 In line with the assessment methodology, as set out in the SMR, SMR Addendum and its appendices, an initial screening process was undertaken (identified in the methodology as Stages A and B) to identify areas of current or historical contaminative use within the study area and to consider which of these areas might pose contaminative risks for the Proposed Scheme. In total, 17 areas were considered during this screening process; five of these areas were taken forward to more detailed risk assessments (Stages C and D), in which the potential risks were assessed more fully. The majority of the areas undergoing the more detailed risk assessments were historical landfills or potentially infilled pits. All areas assessed are shown on Maps LQ-01-021b to 025a (Volume 5, Land Quality Map Book) and those considered as potentially posing a risk to the Proposed Scheme are labelled with a reference number.

[48] British Standard BS10175 *(2011), Investigation of Potentially Contaminated Sites.*
[49] Sustainable Remediation Forum UK (2010), *A Framework for Assessing the Sustainability of Soil and Groundwater Rem*ediation.

8.4.9 Conceptual site models (CSM) have been produced for the five areas taken to Stage C and D assessments. The detailed CSM are provided in Volume 5: Appendix LQ 001-017 (Section 3) and the results of the baseline risk assessments are summarised in this section. Potentially contaminated areas have been grouped and considered together, where appropriate. The following factors have determined the need for Stage C and D assessments:

- whether the area is on or off the Proposed Scheme or associated offline works; e.g. roads;
- the vertical alignment, i.e. whether the Proposed Scheme is in cut or on embankment;
- the presence of underlying Principal or Secondary A aquifers or nearby watercourses; and
- the presence of adjacent residential properties or sensitive ecological receptors.

8.4.10 A summary of the baseline CSM is provided in Table 11. The impacts and baseline risks quoted are before any mitigation is applied. The assessed baseline risk is based on the information provided at the time of the assessment. Where limited information is available, it is based on precautionary, worst case assumptions and may therefore report a higher risk than that which actually exists.

Table 11: Summary of baseline CSM for sites which may pose a contaminative risk for the Proposed Scheme

Area reference	Area name	Main potential impacts	Main baseline risk [3]
11-1	Existing Princes Risborough to Aylesbury Line (Map LQ-01-22, D6)	Exposure of Secondary A Alluvium aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Very low
11-3	Former Hartwell clay, brick and tile works and landfill (Map LQ-01-23, E5)	Exposure of on-site human receptors (commercial) to contamination by direct contact, ingestion and inhalation of contaminants in windblown, soil-derived dusts.	Moderate
		Exposure of on-site human receptors (commercial) to contamination by inhalation of migrating ground-gas and volatile vapours from contaminated water.	Moderate
		Exposure of on-site human receptors (commercial) to asphyxiative or explosive gases.	High
		Exposure of off-site human receptors (residential) to contamination by direct contact, ingestion and inhalation of contaminants in windblown, soil-derived dusts.	Moderate/low
		Exposure of off-site human receptors (residential) to contamination by inhalation of migrating ground-gas and volatile vapours	Moderate/low

Area reference	Area name	Main potential impacts	Main baseline risk [3]
		from contaminated water.	
		Exposure of off-site human receptors (residential) to asphyxiative or explosive gases.	Moderate
		Exposure of Sedrup Ditch to leaching of contaminants from soil to groundwater and lateral migration in groundwater and surface run-off.	Moderate
		Exposure of on-site properties to lateral migration and build-up of asphyxiative or explosive gases.	Moderate
		Exposure of on-site properties to direct contact of property with contaminants in soil and surface water/groundwater.	Low
		Exposure of off-site properties to lateral migration and build-up of asphyxiative or explosive gases.	Moderate
		Exposure of off-site properties to direct contact of property with contaminants in soil and surface water/groundwater.	Very low
11-4	Hartwell Landfill (Map LQ-01-23, F7)	Exposure of Portland Limestone Principal aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Moderate
11-9	Potentially infilled water features (Map LQ-01-22, H6)	Exposure of off-site human receptors (residential) to contamination by direct contact, ingestion and inhalation of contaminants in windblown, soil-derived dusts.	Moderate/low
		Exposure of off-site human receptors (residential) to contamination by inhalation of migrating ground-gas and volatile vapours.	Low
		Exposure of off-site human receptors (residential) to asphyxiative or explosive gases.	Moderate/low
		Exposure of off-site properties to lateral migration and build-up of asphyxiative or explosive gases.	Moderate/low
		Exposure of off-site properties to direct contact of property with contaminants in soil and surface water/groundwater.	Very low
11-17	Former Sewage Works (Map LQ-01-23, D8)	Exposure of secondary Undifferentiated Head deposits and Secondary A Alluvium aquifer to leaching of contaminants from soil to groundwater and vertical and lateral migration in groundwater.	Low
		Exposure of Hartwell Ditch to leaching of contaminants from soil to groundwater lateral	Moderate/low

Area reference	Area name	Main potential impacts	Main baseline risk (3)
		migration in groundwater and surface run-off.	

(1) Each area is assigned a unique identification number (See Volume 5, Appendix LQ-001-011).
(2) CSMs have been prepared as part of the detailed land contamination methodology (refer to Volume 5) for baseline, construction and post-construction.
(3) The moderate or high risks identified reflect the uncertainty in existing baseline information. Whilst there are unlikely to be properties or receptors that experience the reported high or moderate existing baseline risk in the absence of site investigation a precautionary, worst case risk is reported in the table.

Temporary effects

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

8.4.12 Table 12 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 5: Appendix LQ-00-011.

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

Table 12: Summary of temporary (construction) effects

Area references	Area name	Main baseline risk	Main construction risk[1] [2]	Construction temporary effect and significance
11-1	Existing Princes Risborough to Aylesbury Line	Very low	Low	Minor adverse effect (not significant)
11-3	Former Hartwell clay, brick and tile works and landfill	Very low to high	None to moderate	Negligible (not significant)
11-4	Hartwell Landfill	Moderate	High	Minor adverse effect (not significant)
11-9	Potentially in-filled water features	Very low to moderate/low	Very low to moderate/low	Negligible (not significant)
11-17	Former sewage works	Low to moderate/low	Low to moderate/low	Negligible (not significant)

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

8.4.14 Table 12 indicates that based upon the assessment, the construction phase is expected to have a temporary negligible to minor adverse effect on the receptors overall. This effect is not considered to be significant in relation to potential land contamination.

8.4.15 Risks to the Secondary A Alluvium and the Principal Portland Limestone Aquifers from vertical and lateral migration of contaminated groundwater/leachate are considered to be higher from the existing Princes Risborough to Aylesbury Line and the Hartwell landfill respectively during construction as they are directly located within the area of cutting for the Proposed Scheme. Therefore, the potential exists to mobilise contaminants during construction works in these areas and this could result in a minor adverse effect that will not be significant.

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

Permanent effects

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

8.4.18 Table 13 includes the summary of the permanent (post-construction) effects obtained from a comparison of the baseline and post-construction impacts and whether these are significant. The details of these comparisons are presented in Volume 5: Appendix LQ 002-011.

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

Site ref (1) Area reference	Site Area name	Main baseline risk	Main post-construction risk[1]	Post -construction effect and significance
11-1	Existing Princes Risborough to Aylesbury Line	Very low	Very low	Negligible (not significant)
11-3	Former Hartwell clay, brick and tile works and landfill	Very low to high	None to moderate	Negligible (not significant)
11-4	Hartwell Landfill	Moderate	Moderate	Negligible (not significant)
11-9	Potentially infilled water features	Very low to moderate/low	Very low to moderate/low	Negligible (not significant)
11-17	Former sewage works	Low to moderate/low	Low to moderate/low	Negligible (not significant)

(1) The low/moderate main construction risk identified in the above table does not necessarily imply an unacceptable risk. Application of the processes and measures within the CoCP will ensure that site risks during the construction stage are controlled.

8.4.19 The magnitude of the permanent effects and their significance have been determined by calculating the change in risk between the main baseline risk and the main post-construction risk. Therefore, where there is no change between the main baseline risk and the main post-construction risk, the permanent effect significance is deemed to be negligible even if the risk is assessed to remain as high. This will be the case where the construction of the Proposed Scheme does not alter the risks from an existing potentially contaminated site that is outside the construction boundary.

8.4.20 Table 13 shows that the Proposed Scheme results in either a reduction or no change in the level of risk already existing at each site for both on site and off site receptors.

8.4.21 Table 13 indicates that, following remediation, there will be an overall negligible effect, and that none of the post-construction effects of land contamination impacts that have been predicted, are significant.

8.4.22 At the former Hartwell clay, brick and tile works a permanent road diversion will overlie the former works/landfill that will remove pollutant linkages and this will result in no significant effects.

Mining/mineral resources

8.4.23 There are no areas in this part of the route that are currently being worked or that have planning permission. In addition, this area of the route will not cross a preferred mineral site, a mineral safeguarding area or a mineral consultation area.

Geo-conservation sites

Temporary effects

8.4.24 Part of the stone wall forming the boundary to the Hartwell Estate is designated as a LGS. Whilst a very short section of the stone wall will be affected by the realigned southern access to Hartwell House, these effects will not be significant and therefore no further mitigation measures are recommended. Construction activity (vibration, vehicle movements etc.) has the potential to affect stability of the stone wall.

8.4.25 Mitigation measures will take the form of barriers to prevent vehicles coming into contact with the wall. If activity is particularly close, the possible use of vibration sensors and short term temporary support to the wall will be undertaken.

Permanent effects

8.4.26 Mitigation measures will be implemented to prevent temporary effects to the stone wall at the Hartwell Estate, and hence no permanent effects are predicted.

Other mitigation measures

8.4.27 At this stage, no additional mitigation measures are considered necessary to mitigate risks from land contamination at construction phase beyond those set out in the draft CoCP and instigated as part of required remediation strategies.

8.4.28 The CoCP details the approach to managing potential land contamination matters. No additional mitigation measures are considered necessary to mitigate risks from land contamination at construction phase beyond those set out in the draft CoCP and instigated as part of required remediation strategies.

Summary of likely significant residual effects

8.4.29 No likely significant adverse effects are anticipated as a result of the application of the mitigation measures detailed above.

8.5 Effects arising from operation

8.5.1 Users of the Proposed Scheme (i.e. rail passengers), whilst within trains, are at all routine times within a controlled environment, and have therefore been scoped out of the assessment.

Avoidance and mitigation measures

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

Assessment of impacts and effects

8.5.3 An express feeder auto-transformer station will be located at Sedrup. An auto-transformer station can, in principle, be a source of contamination through accidental discharge or leaks of coolant. However, the proposed auto-transformer station, in common with other modern substations, will use secondary containment appropriate to the level of risk.

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

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

Other mitigation measures

8.5.6 No other mitigation measures will be required beyond what has already been outlined relating to land quality in the Stoke Mandeville and Aylesbury study area.

8.5.7 There may be ongoing monitoring requirements following remediation works carried out during construction. Such monitoring, including monitoring of groundwater quality or ground gas, could extend into the operational phase of the Proposed Scheme

Summary of likely significant residual effects

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

9 Landscape and visual assessment

9.1 Introduction

9.1.1 This section reports the assessment of the likely significant landscape and visual effects. It starts by summarising the baseline conditions found within and around the route of the Proposed Scheme and goes on to describe the significant effects that will arise during construction and operation on landscape character areas (LCA) and visual receptors.

9.1.2 In this section, the operational section refers not just to the running of the trains but also the presence of the new permanent infrastructure associated with the Proposed Scheme.

9.1.3 Principal landscape and visual issues in the area include:

- temporary effects to LCA and visual receptors during construction arising from the presence of construction plant and construction compounds, removal of existing vegetation and severance of agricultural land; and
- permanent landscape and visual effects during operation arising from the presence of new engineered landforms cutting across the existing landscape, a new viaduct, noise fence barriers, highway and rail infrastructure, overhead line equipment, balancing ponds and regular passing of high speed trains. Permanent effects will reduce over time as planting established as part of the Proposed Scheme matures.

9.1.4 A separate but related assessment of effects on the setting of heritage assets is included in Section 6. Further details on the landscape and visual assessment, including engagement, baseline information and assessment findings, are presented in Volume 5: Appendix LV-001-011, which comprises the following:

- Part 1 Engagement with technical stakeholders;
- Part 2 Environmental baseline report;
- Part 3 Assessment matrices; and
- Part 4 Schedule of not significant effects.

9.1.5 The extent of the landscape and visual study area, the distribution of visual receptor viewpoints and the location of verifiable photomontages has been discussed with Buckinghamshire County Council, Chiltern District Council, Wycombe District Council, Aylesbury Vale District Council, National Trust, and the Chilterns Conservation Board. Summer field surveys, including photographic studies of LCA and visual assessment of viewpoints, were undertaken from July to October 2012 and from May to June 2013. Winter surveys were undertaken from January to March 2013.

9.2 Scope, assumption and limitations

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

9.2.2 The study area has been informed by the construction and operational phase zones of theoretical visibility (ZTV) that are shown in Maps LV-07-038 to LV-07-043 and LV-08-038 to LV-08-043 (Volume 5, Landscape and Visual Assessment Map Book). The ZTV has been produced in line with the methodology described in the SMR Addendum (Volume 5: Appendix CT-001-000), and is an indication of the theoretical visibility of the Proposed Scheme. In some locations, extensive vegetation cover will mean the actual visibility is substantially less than that shown in the ZTV. Tall construction plant (e.g. cranes and piling rigs) are excluded from the ZTV for the construction phase and overhead line equipment is excluded from the ZTV for the operational phase, but these are described and taken in to account in the assessment of effects on LCA and visual receptors.

9.2.3 LCA and visual receptors within approximately 1km of the Proposed Scheme have been assessed. Long distance views of up to 2km have been considered at locations such as Eythrope and Bishopstone on PRoW and minor roads.

Limitations

9.2.4 During the baseline survey there were some areas that were inaccessible (such as private land, commercial premises and residential buildings). In these instances, professional judgement has been used to approximate the likely views from these locations.

9.2.5 The only viewpoint that does not have a representative photograph for both the winter and summer months is viewpoint 124.6.001: View south-west from Rabans Lane Industrial Park near Hartwell View, Aylesbury.

9.3 Environmental baseline

Existing baseline

Landscape baseline

9.3.1 The landscape comprises a series of gently undulating clay vales that lie within a wider landscape setting encompassing plateaus divided by broad valleys. Smooth chalk hills and plateaus provide the setting to the south just outside the study area, whilst to the north-west a low irregular limestone ridge is present within the study area. The area supports mixed farmland although arable land predominates, with more limited areas of pasture commonly located adjacent to streams and on the fringe of settlements. The study area contains a number of built-up areas, the largest of which is Aylesbury to the north-east. Other notable settlements include Stoke Mandeville, Weston Turville, Bishopstone, Upper Hartwell, Lower Hartwell and Stone. A new area of settlement is currently under development to the north of the study area at Berryfields.

9.3.2 Woodland cover is generally sparse and is mostly focused around Hartwell and Eythrope. Managed hedgerows bound the large scale arable fields and the smaller scale pastoral fields with occasional shelterbelts. A primary road, the A418 Oxford Road bisects the study area in a broadly west to east orientation. The A41 Bicester Road serves the area to the north whilst the A413 Wendover Road serves the area to the south; both orientated broadly north-west to south-east. Two rail lines also feature in the study area, the Marylebone to Aylesbury Line and the Princes Risborough to Aylesbury Line. A number of PRoW pass through the study area and are considered to be valuable recreational resources including the following:

- North Bucks Way;
- Midshires Way;
- Bernwood Jubilee Way;
- Swan's Way;
- Aylesbury Ring; and
- Thame Valley Walk.

9.3.3 The LCA have been determined with reference to the Landscape Plan for Buckinghamshire[50], the Aylesbury Vale LCA[51] and the Wycombe District LCA[52], and refined where applicable.

9.3.4 Descriptions of all LCA are provided in, Volume 5: Appendix LV-001-011, Part 2. For the purposes of this assessment the study area has been sub-divided into 12 discrete LCA, four of which are most likely to be affected. A summary of these LCA is provided below. The LCA are shown on Maps LV-02-038 to LV-02-043 (Volume 5, Landscape and Visual Assessment Map Book).

[50] Buckinghamshire County Council (2001), *Landscape Plan for Buckinghamshire Part 1: Landscape Character Assessment*.
[51] Jacobs (2008), *Aylesbury Vale Landscape Character Assessment: Prepared for Buckinghamshire County Council and Aylesbury Vale District Council*.
[52] Land Use Consultants (2011), *Wycombe District Landscape Character Assessment: Prepared for Buckinghamshire County Council and Wycombe District Council*.

Stoke Mandeville Vale LCA

9.3.5 This is a low lying landscape with limited topographic variation. The chalk escarpment of the Chilterns AONB rises up to form a distinct edge and forms part of the wider landscape setting. The predominant land use is agricultural, comprising large open arable fields, with smaller parcels of pasture on the edge of settlements. In comparison to the other LCA adjacent to Aylesbury, this area is relatively densely settled with two large villages: Stoke Mandeville and Weston Turville. Evidence of historic land uses is present in the landscape including features such as the site of the site of the former Church of St Mary's and associated graveyard. The general landscape pattern is interrupted by the ribbon development, including that in the vicinity of Stoke Mandeville and Weston Turville, and transport infrastructure, including the A413 Wendover Road, the A4010 Risborough Road and the Marylebone to Aylesbury Line. As a consequence the landscape is in a fair condition with some pockets of higher quality and better managed agricultural land. The LCA is likely to be valued by the local community and by users of the extensive PRoW network.

9.3.6 Tranquillity in the area is considered to be low given the visual influence of developed areas eroding the sense of seclusion in combination with the presence of existing transport infrastructure and associated vehicular movements. Therefore, this area has a low sensitivity to change.

Haddenham Vale LCA

9.3.7 This low lying area on the south-western fringe of the town of Aylesbury is likely to be valued locally by residents in the area and users of the PRoW network. The chalk escarpment of the Chilterns AONB is present in the backdrop of views to the south and contributes to the wider landscape setting of this LCA. The landscape is otherwise uncontained and remote due to the limited topographic variation, lack of settlement, scarcity of woodland and absence of infrastructure. Agricultural land predominantly comprises large-scale arable fields, with smaller scale pastoral fields located adjacent to watercourses. The pattern of hedgerows is distinctive and hedgerows are generally well-maintained. Mature trees, where present, reinforce the coherent pattern of elements such as the distinctive hedgerows. Generally the elements within the LCA are in good condition.

9.3.8 Settlement is generally sparse with the exception of dispersed farmsteads. The lack of large scale settlement and transport infrastructure results in an area with a high level of tranquillity. Therefore, this area has a medium sensitivity to change.

Hartwell House and Golf Course LCA

9.3.9 This LCA comprises two distinct areas, the landscape of Hartwell House and the Aylesbury Park Golf Course, both of which exhibit a strong parkland character throughout. The landscape of the Grade I listed Hartwell House has a secluded character and is enclosed by mature, well-wooded parkland, whilst the landscape of the golf course tends to be slightly more open, albeit still wooded. An avenue of trees extends from Hartwell House across the parkland and Aylesbury Park Golf Course, unifying these two distinct areas. The landscape is in a generally good condition, although the tree avenue exhibits signs of decline in places. The pattern of distinctive elements, including the extent of woodland cover and the tree avenue, combine to give a strong sense of cohesion.

9.3.10 Detracting features within the area are minimal although there is intervisibility with residential and industrial developments to the north and north-east from within the Aylesbury Park Golf Course. However, generally the landscape is enclosed and given the lack of infrastructure and the sense of seclusion this affords, the area has a high level of tranquillity and is perceived as a quiet area of retreat.

9.3.11 The grounds of Hartwell House are recognised as one of Buckinghamshire's finest estates and the landscape is listed as Grade II* on the English Heritage Register of Historic Parks and Gardens of Special Historic Interest in England[53]. As such, the LCA is of national value. Therefore, this area has a high sensitivity to change.

Fleet Marston Vale LCA

9.3.12 The landscape of the Fleet Marston Vale is open, with a low level of settlement, limited topographic variation and a large scale field pattern. The elevated landscape to the north and south defines the visual horizon and wider landscape setting outside of this LCA.

9.3.13 The predominant land use is agricultural, with large scale, open arable fields bounded by well-trimmed hedgerows. However, in some instances there is a noticeable loss of hedgerows as a result of field amalgamation. Woodland cover is limited to watercourses. As a result, the landscape is considered to be in a fair condition with limited distinctive components.

9.3.14 Despite the sense of being in a rural environment the LCA is traversed by busy transport routes including the A41 Bicester Road, along which development has occurred. The extensive development at Berryfields (specified as the Settlement (Berryfields) LCA) lies adjacent to the Fleet Marston Vale LCA. Therefore noise and visual detractors are present in the landscape and exert their influence across the LCA. On this basis the level of tranquillity is considered to be low. A very small proportion of the LCA lies within the Brill-Winchendon Hills Area of Attractive Landscape, and as such is likely to be valued locally. Therefore, this area has a low sensitivity to change.

[53] English Heritage (2008), *English Heritage Register of Parks and Gardens of Special Historic Interest*.

Visual baseline

9.3.15 Descriptions of the identified representative viewpoints are provided in Volume 5: Appendix LV-001-011 Part 2. A summary description of the distribution and types of receptors most likely to be affected is provided in this section. The viewpoints are shown on Maps LV-03-038 to LV-03-043 and LV-04-038 to LV-04-043 (Volume 2, CFA11 Map Book). In each case, the middle number (xxx.x.xxx) identifies the type of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 6: Employment, 7: Active Sports.

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

9.3.17 Residential receptors have a high sensitivity to change and are generally located on the periphery of Stoke Mandeville, Aylesbury, Berryfields and Hartwell. These are in addition to isolated farmsteads throughout the study area and groupings of properties in the vale landscape at Fleet Marston. Views are typically across flat or gently undulating agricultural fields bounded by hedgerows. In views to the south, the elevated chalk escarpment often forms the backdrop to the view.

9.3.18 Recreational receptors, also with a high sensitivity to change, are located on PRoW throughout the study area, including the North Bucks Way, the Midshires Way, the Bernwood Jubilee Way, the Swan's Way, the Aylesbury Ring and the Thame Valley Walk. The viewpoints are typically located in agricultural locations, with farmed fields forming the foreground of the view and planted field boundaries forming some degree of enclosure and screening to the wider landscape.

9.3.19 Viewpoints from people travelling along scenic roads have a medium sensitivity to change and are commonly located on lanes connecting some of the smaller settlements within the study area. People travelling on main roads such as the A418 Oxford Road, the A413 Wendover Road and the A41 Bicester Road have a low sensitivity to change. These views are characterised by pockets of development or agricultural farmland bounded by hedgerows, grass verges and timber post and wire fencing, offering varying degrees of openness.

Future baseline

9.3.20 A summary of the committed developments that are assumed to be built and occupied prior to either the construction or operation of the Proposed Scheme is provided below, along with the consequential effect on the character of LCA and nature of views. Developments that will introduce new visual receptors that may be significantly affected are also described. These developments are listed in Volume 5: Appendix CT-004-000 and shown on Maps CT-13-021 to CT-13-025 (Volume 5, Cross Topic Appendix 1 Map Book).

Construction (2017)

9.3.21 The Berryfields Major Development Area (MDA) is situated to the north-west of Aylesbury. The development will include the provision of approximately 3,000 new homes, a district centre, schools and improved transport connections to the A41 Bicester Road and the Aylesbury Vale Parkway train station. Development at Berryfields has already begun and constitutes the start of the Settlement (Berryfields) LCA. Upon completion of the development the condition of the landscape will be improved and the sensitivity of this LCA will increase to medium during construction.

9.3.22 Views from within the Berryfields MDA are likely to be restricted due to the built-up nature of the development, whilst those on the periphery are likely to remain unchanged.

9.3.23 Although additional receptors will be introduced into the landscape, these are deemed to be suitably represented by the viewpoint locations identified at the baseline stage of this assessment.

Operation (2026)

9.3.24 By 2026, the tree planting established by the Berryfields MDA development will have matured although it will not discernibly alter the character of the Settlement (Berryfields) LCA in comparison to 2017. The sensitivity of this area will remain as medium during year 1 of operation.

9.3.25 Views from within and on the periphery of the Berryfields MDA will largely remain unchanged and are deemed to be suitably represented by the viewpoint locations identified at the baseline stage of this assessment.

9.4 Temporary effects arising during construction

9.4.1 As is commonplace with major infrastructure works, the scale of the construction activities means that works will be visible in many locations and will have the potential to give rise to significant temporary effects that cannot be mitigated practicably. Such effects are temporary and vary over the construction period depending on the intensity and scale of the works at the time. The assessment of landscape and visual effects has been based on the activities occurring during the peak construction phase that is defined as the period during which the main civil engineering works will take place, including establishment of compounds, main earthworks and structure works. The effects associated with the peak construction phase in this area will generally be considered to be long term given the construction programme (See Section 2.3). Overall, civil engineering works in this area will be undertaken between the middle of 2017 and the start of 2021. The A41 Bicester Road embankment main compound will be in place for approximately four years. Satellite compounds will be in place for between approximately two and a half years and three years. The civil engineering works at most individual sites along the route in this area will occur for a period between approximately six months and three years. Effects during other phases of works are likely to be lesser due to less construction equipment being required at the time and a reduced intensity of construction activity. The permanent effects of the

presence of the Proposed Scheme are described in the operational assessment section.

9.4.2 The construction works that have been taken into account in determining the effects on landscape and visual receptors includes:

- construction of the new A4010 Stoke Mandeville bypass;
- construction of the Princes Risborough to Aylesbury rail overbridge;
- construction of the A418 Oxford Road overbridge;
- construction of the Thame Valley viaduct;
- construction of the A41 Bicester Road realignment;
- presence of the A418 Oxford Road roadhead and the A41 Bicester Road roadhead and associated vehicular movements;
- general realignment and construction of temporary and permanent utility connections; and
- general earthworks along the Proposed Scheme requiring cut/fill, vegetation removal, modification of landform, temporary closures and the presence of construction plant and worksites.

Avoidance and mitigation measures

9.4.3 Measures that have been incorporated in the draft CoCP to avoid or reduce landscape and visual effects during construction include the following (see Volume 5: Appendix CT-003-000/1):

- designing lighting to avoid unnecessary intrusion onto adjacent buildings and other land uses (draft CoCP, Section 5.4);
- use of well-maintained hoardings and fencing (draft CoCP, Section 5.6);
- a requirement for contractors to pay due consideration to the impacts of extreme weather events and related conditions that may affect landscape and visual resources during construction (draft CoCP, Section 5.10);
- maximising the retention and protection of existing trees and vegetation where possible (draft CoCP, Section 12.2);
- replacement of any trees intended to be retained that may be accidentally felled or die as a consequence of construction works (draft CoCP, Section 12.2); and
- appropriate maintenance of planting and seeding works and implementation of management measures, to continue through the construction period as landscape works are completed (draft CoCP, Section 12.4).

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

Assessment of impacts and effects

9.4.5 The most apparent changes to landscape character and views during construction will relate to the temporary presence of construction plant, the opening up of views due to the demolition of properties, the removal of existing landscape elements, such as trees, hedges and agricultural land, creation of cuttings and embankments, the presence of temporary material stockpiles, and the emergence of new structures in the landscape. Changes will be most notable in the vicinity of Stoke Mandeville, where construction of the new A4010 Stoke Mandeville bypass and the Princes Risborough to Aylesbury rail overbridge will be prominent activities in a flat and open landscape. Changes will also be most noticeable in the vicinity of Hartwell House where construction activities associated with the Proposed Scheme will be visible and also in the vicinity of Fleet Marston, where construction of the A41 Bicester Road realignment will be visible.

9.4.6 The height of the construction plant and the proximity of construction activities to viewpoints, coupled with intermittent intervening screening (apart from the site hoardings) will result in significant visual effects during construction. The topography in certain locations and the retention of intervening hedgerows and trees will partially screen ground level construction activity including from some long-distance elevated locations.

Landscape assessment

9.4.7 The following section describes the likely significant effects on LCA during construction. All LCA within the study area considered to experience an effect that will not be significant (minor or negligible) are described in Volume 5: Appendix LV-001-011 Part 4.

Stoke Mandeville Vale LCA

9.4.8 The Proposed Scheme will pass through this LCA for approximately 2.5km from a point between the former site of the Church of St Mary's and graveyard and the Princes Risborough to Aylesbury Line. Activities will include the construction of a maintenance loop (approximately 1.2km length) in the vicinity of the site of the Church of St Mary's with an associated access track, the new A4010 Stoke Mandeville bypass, the Princes Risborough to Aylesbury Line realignment, and the realignment of three PRoW. The Risborough Road satellite compound will be located within this LCA. Temporary material stockpiles will also be introduced into the landscape and there will be increased vehicle movements along the A413 Wendover Road associated with construction activity.

9.4.9 The visual intrusion of construction activities will noticeably reduce the perception of tranquillity in the immediate vicinity of the Proposed Scheme. However the extent of visual intrusion will reduce with distance due to the abundance of intervening vegetation in the flat landscape.

9.4.10 The direct impacts on landscape components will be localised. Across the LCA, the generally large and open fields and hedgerows will for the most part be retained and intervisibility with the chalk escarpment to the south will largely be preserved. However, there will be some severance of agricultural land, hedgerows and vegetation associated with the Stoke Brook. The construction activities will be present within the context of the existing urban influences throughout the area and will directly impact a small proportion of this LCA. However satellite compounds and emerging structures will be prominent new elements in localised areas.

9.4.11 Whilst tranquillity is likely to be reduced in the immediate vicinity of the construction activities, these additional elements in the landscape will not affect the setting across the majority of the Stoke Mandeville Vale LCA. On this basis, the magnitude of change is considered to be medium.

9.4.12 The medium magnitude of change, assessed alongside the low sensitivity of the character area, will result in a moderate adverse effect.

Haddenham Vale LCA

9.4.13 The Proposed Scheme will run through the Haddenham Vale LCA between the existing Princes Risborough to Aylesbury Line and the A418 Oxford Road for approximately 3km. Construction activities will include earthworks (cuttings up to approximately 7m depth and embankments up to approximately 6m height), the A418 Oxford Road realignment, and provision of PRoW diversions. Construction of the Proposed Scheme will also necessitate the demolition of Glebe House (a Grade II listed property). The Princes Risborough to Aylesbury rail overbridge satellite compound and the Oxford Road overbridge satellite compound will be located in this LCA. Temporary material stockpiles will also be introduced into the landscape.

9.4.14 The removal of hedgerows and hedgerow trees will result in direct impacts, disrupting the pattern of elements in the vale. This will reduce the coherence of the landscape by removing these unifying features. Construction activities will be noticeably out of character within this farmed landscape, where an absence of major development is a key characteristic.

9.4.15 Construction activities will reduce tranquillity to the east of Bishopstone as they will introduce visual detractors into this largely rural setting.

9.4.16 The partial loss of key characteristics, the noticeable reduction in tranquillity and the introduction of construction activity in the LCA results in a magnitude of change considered to be medium.

9.4.17 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect.

Hartwell House and Golf Course LCA

9.4.18 The Proposed Scheme will pass through this LCA between the A418 Oxford Road and the Thame Valley Walk PRoW for approximately 1.7km. Construction activities will include the formation of earthworks (cuttings up to approximately 8m depth and embankments up to approximately 4m height) and the realignment of two PRoW, including the Thame Valley Walk. Vegetation will be removed, including part of Rifle Spinney and part of the Hartwell Estate historic tree avenue. Temporary material stockpiles will also be introduced into the landscape, to the north-east of the route of the Proposed Scheme.

9.4.19 The visual interruption of construction activities in the centre of this LCA will lead to a marked reduction in tranquillity across the majority of this LCA.

9.4.20 Direct impacts on landscape components will include the loss of a large proportion of woodland and grassland, in addition to the severance of part of an historic tree avenue that is a key characteristic of the landscape. The marked reduction in tranquillity, in combination with the presence of temporary landscape features, will disrupt the tangible connection to the historic landscape of this LCA. Given the considerable impacts within this historic landscape setting, the magnitude of change is considered to be high.

9.4.21 The high magnitude of change, assessed alongside the high sensitivity of the character area, will result in a major adverse effect.

Fleet Marston Vale LCA

9.4.22 The Proposed Scheme will run through this LCA from the Thame Valley Walk PRoW towards Fleet Marston for approximately 3km. Construction activities will include earthworks (cuttings up to an approximate depth of 5m and embankments up to an approximate height of 3m), the construction of the Thame Valley viaduct (approximate length of 940m), the A41 Bicester Road realignment and the realignment of a series of PRoW. The Thame Valley viaduct satellite compound in the vicinity of Putlowes and the A41 Bicester Road embankment main compound in the vicinity of Cranwell Farm will be located within the Fleet Marston Vale LCA. There will also be intervisibility with the A41 Bicester Road roadhead in the adjacent Waddesdon and Quainton area (CFA12). Other impacts within this LCA will include the removal of a small proportion of hedgerow, watercourse and woodland vegetation, in combination with the severance of agricultural land. Temporary material stockpiles will also be introduced into the landscape along the majority of the eastern side of the Proposed Scheme. Furthermore, traffic will be increased along the A41 Bicester Road.

9.4.23 Construction activities will be focused in the south-west of this LCA, in proximity to the A41 Bicester Road. The visual intrusion of plant and machinery in the landscape will discernibly reduce tranquillity. Overall, the magnitude of change is considered to be medium.

9.4.24 The medium magnitude of change, assessed alongside the low sensitivity of the character area, will result in a moderate adverse effect.

Visual assessment

9.4.25 The following section describes the likely significant effects on visual receptors during construction. The construction assessment has been undertaken during winter, in line with best practice guidance, to ensure a robust assessment. However, in some cases, visibility of construction activities may be reduced during summer when vegetation, if present in a view, will be in leaf. Where residential receptors experience significant effects at night-time arising from additional lighting, these are also presented in this section. Representative viewpoints within the study area considered to experience an effect that will not be significant (minor or negligible) are described in Volume 5: Appendix LV-001-011 Part 4.

9.4.26 The number identifies the viewpoint locations which are shown on Maps LV-03-038 to LV-03-043 (Volume 2, CFA11 Map Book). In each case, the middle number (xxx.**x**.xxx) identifies the type of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 6: Employment and 7: Active Sports.

9.4.27 Where a viewpoint may represent multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with a lower sensitivity may be lower than those reported.

Viewpoint 111.2.001: View east from dwellings on Old Risborough Road

9.4.28 Views of construction activities in the foreground (approximately 70m from the viewpoint) will be partially obscured by the hedgerow running along Old Risborough Road at ground level and will be open from first floor windows. Plant and machinery will be clearly visible in the middle ground from residences along Old Risborough Road, in particular those associated with the decommissioning of the A4010 Risborough Road. These activities will partially restrict views towards Wendover Woods in the background of the view. In the foreground, plant and machinery associated with the removal of roadside vegetation, topsoil stripping and earthworks for the route will also be visible. Given the short distance between the receptor and the extent of construction activities visible, there will be a substantial change within the direct field of view. On this basis, the magnitude of change is considered to be high.

9.4.29 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

9.4.30 Additional lighting associated with construction of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-010, Part 4.

Viewpoint 112.2.002: View south-west from Stoke House, Stoke Mandeville

9.4.31 Construction activities will be visible in the middle ground (approximately 120m from the viewpoint) from both ground and first floor levels. To the left of the view, the removal of intervening vegetation across the foreground and middle ground will result in views of plant and machinery associated with the construction of the maintenance loop being afforded. Views towards the wooded chalk escarpment backdrop will be partially obscured by plant and machinery in the middle ground. Given the presence of incongruous activities the direct field of view, in proximity to the viewpoint, the magnitude of change is considered to be high.

9.4.32 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.33 Additional lighting associated with construction of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-010, Part 4.

Viewpoint 112.4.001: View west from A4010 Risborough Road, Stoke Mandeville

9.4.34 There will be open views of construction activities including earthworks that will be prominent within the foreground and middle ground (approximately 90m from the viewpoint). The removal of mature vegetation along the length of both the A4010 Risborough Road and Old Risborough Road will be clearly evident, opening up views towards the existing pylons. Given the substantial alteration in the existing view, including the loss of mature vegetation in proximity to the viewpoint, the magnitude of change is considered to be high.

9.4.35 The high magnitude of change, assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 113.4.001: View east from Marsh Lane, Marsh

9.4.36 Construction activities associated with the new A4010 Stoke Mandeville bypass and the route will be clearly visible in the foreground and middle ground (approximately 50m from the viewpoint). Vegetation along the length of Marsh Lane will be removed, opening up views beyond towards the western fringe of Stoke Mandeville in the background and views of earthworks associated with the Proposed Scheme in the adjacent arable fields in the middle ground. Temporary material stockpiles will be visible between the new A4010 Stoke Mandeville bypass and the route.

9.4.37 Given these substantial alterations, including the removal of mature vegetation in proximity to the viewpoint, the magnitude of change is considered to be high.

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

Viewpoint 114.2.002: View west from Moat Farm, Stoke Mandeville

9.4.39 Construction activities associated with the route will be clearly visible across the middle ground of this view, including the removal of vegetation and the construction of new structures (approximately 160m from the viewpoint). Activities associated with the construction of the new A4010 Stoke Mandeville bypass will be visible beyond the route. To the right of the view, plant and machinery associated with the realignment of the Princes Risborough to Aylesbury Line will be apparent, particularly in views from first floor levels. The wooded chalk escarpment in the background of the view will be partially obscured by the plant and machinery in the middle ground. Considering this, the magnitude of change is considered to be high.

9.4.40 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.41 Additional lighting associated with construction of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-010, Part 4.

Viewpoint 115.3.001: View east from PRoW (Footpath SMA/16) near Standall's Farm, Bishopstone

9.4.42 Construction activities will be clearly visible within the arable field in the middle ground (approximately 250m from the viewpoint). The plant and machinery required to construct the cutting for the route of the Proposed Scheme and for the realignment of the Princes Risborough to Aylesbury Line and the Footpath SMA/16 accommodation overbridge will be particularly prominent. The Princes Risborough to Aylesbury rail overbridge satellite compound will also be clearly visible. To the left of the view, construction activities will be partially screened by the hedgerow vegetation in the foreground. A temporary material stockpile area in the middle ground will appear as an incongruous element in the landscape, but will also partially screen views of construction activity. Overall, the magnitude of change is considered to be high.

9.4.43 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 116.3.001: View south-west from the Round Aylesbury Walk PRoW (Footpath SMA/16), Southcourt

9.4.44 Construction activities, in particular the plant and machinery required to construct the Aylesbury South cutting, will be visible within the foreground of this view (approximately 100m from the viewpoint), although progressively obscured by the cutting itself. Construction activities associated with the creation of mitigation earthworks will also be clearly visible in the foreground. The Princes Risborough to Aylesbury rail overbridge satellite compound will be visible to the left of the view in the middle ground. To the right of the view the construction of the Footpath SMA/16 accommodation overbridge will form a prominent element, whilst further right, the removal of vegetation will open up views across an arable field where additional construction activities associated with the Proposed Scheme will be visible. Views towards the backdrop will be obscured by plant and machinery; however this will be seen in the context of a backdrop containing pylons and overhead high voltage power

lines. Temporary material stockpiles will be visible beyond the route across the extent of the view. Given the extent of works visible, in the direct field of view, the magnitude of change is considered to be high.

9.4.45 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 117.3.001: View east from the Midshires Way PRoW (Bridleway SBH/19), Bishopstone

9.4.46 Construction activities will be visible across the middle ground (approximately 550m from the viewpoint), either side of the hedgerow running perpendicular to the viewpoint. The plant and machinery required to construct earthworks will be visible albeit partially screened by the intervening vegetation, as will the tall plant associated with the PRoW realignments to the left and right of the view (Footpath SBH/27 overbridge and Bridleway SBH/1 overbridge respectively). On this basis, the magnitude of change is considered to be medium.

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

Viewpoint 118.3.002: View west from the Round Aylesbury Walk PRoW (Footpath SBH/27), Southcourt

9.4.48 There will be intermittent, ground level views of the construction activities through gaps in the hedgerow in the middle ground. Larger plant and machinery will be visible across the majority of this view (approximately 150m from the viewpoint at their nearest point), although a cluster of mature trees to the right of the view will restrict views towards the A418 Oxford Road realignment. To the left of the view, plant and machinery associated with the earthworks for the Footpath SBH/27 overbridge will be clearly visible. A temporary material stockpile area will be visible beyond the route to the left of the view through the gaps in the intervening hedgerow. Given the extent of construction activities visible, the magnitude of change is considered to be high.

9.4.49 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 119.2.001: View east from dwellings on Mayflower Close, Hartwell

9.4.50 Construction activities associated with the realignment of the A418 Oxford Road will be dominant in the foreground from both ground and first floor levels with the A418 Oxford Road roadhead clearly visible (approximately 100m from the viewpoint). Visibility of vehicular movements, along with the construction of the route and temporary material stockpile areas, will also be prominent in the middle ground. Wendover Woods, in the background of the view, will be partially obscured by plant and machinery. Given these substantial alterations in proximity to the viewpoint, the magnitude of change is considered to be high.

9.4.51 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.52 Additional lighting associated with the A418 Oxford Road realignment will increase the extent of lighting in the foreground and middle ground. The A418 Oxford Road overbridge satellite compound, located in the background of the view will increase the extent of sky glow associated with the settlement of Aylesbury. Therefore, the magnitude of change to this receptor at night-time is considered to be low, resulting in a moderate adverse effect.

Viewpoint 119.2.002: View east from Sedrup Farm, Sedrup

9.4.53 Views of construction activities in the background of this view (approximately 500m from the viewpoint) will be partially screened by the intervening topography and vegetation in the foreground and middle ground. Where plant and machinery will be visible, it will generally be seen against a vegetated backdrop alongside other vertical infrastructure elements such as pylons and telegraph poles. In the centre of the view, construction activities associated with the Footpath SBH/34 accommodation overbridge will be partially visible. However the removal of vegetation across the extent of the view between the middle ground and background will be barely perceptible due to the abundance of intervening vegetation. Given that construction activities will be mostly screened by intervening vegetation and landform, the magnitude of change is considered to be low.

9.4.54 The low magnitude of change, assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect.

9.4.55 Additional lighting associated with construction of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-010, Part 4.

Viewpoint 120.4.002: View west from the A418 Oxford Road adjacent to Hartwell House, Hartwell

9.4.56 The construction works, including the removal of mature vegetation, will be clearly visible in the background of the view (approximately 120m from the viewpoint). The removal of the Hartwell Estate boundary wall will be apparent where the Proposed Scheme will traverse the A418 Oxford Road. In consideration of this, the magnitude of change is considered to be high.

9.4.57 The high magnitude of change, assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect.

Viewpoint 121.2.001: View north-east from dwellings in Upper Hartwell

9.4.58 Construction activities will be visible in between the middle ground and background of this framed, slightly elevated view (approximately 500m from the viewpoint) in the context of existing infrastructure elements such as pylons. Plant and machinery associated with vegetation removal and the construction of an approximately 5m deep cutting will be partially screened by vegetation in the middle ground beyond Lower Hartwell Farm in the centre of the view. In front of these activities, plant and machinery associated with earthworks, further vegetation removal and planting will be apparent in the view. Construction activities associated with the Thame Valley viaduct to the left of the view and the Footpath SBH/32 overbridge to the right of the

view will be screened by the intervening vegetation in the foreground. Overall, the magnitude of change is considered to be low.

9.4.59 The low magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a moderate adverse effect.

9.4.60 Additional lighting associated with construction of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-010, Part 4.

Viewpoint 121.2.002: View east from dwellings in Lower Hartwell

9.4.61 Construction activities (approximately 300m from the viewpoint) will be partially screened by the mature trees in the tree avenue in the centre of the middle ground in this view, whereby plant and machinery visible in the background of the view will be restricted to glimpsed views. Hedgerows, with large mature trees, bounding the pasture in the middle ground to the left and right of the view will further screen construction activities. However, vegetation removal in the background of the view will be apparent, in particular where the Bridleway SBH/2 overbridge will be located, resulting in a noticeable deterioration in the existing view. To the left of the view, plant and machinery associated with the construction of mitigation earthworks will be partially visible beyond the hedgerow bounding the pasture in the middle ground. A temporary material stockpile area will be present, albeit barely perceptible to the centre right of the view in the background, beyond the route itself. Given this, the magnitude of change is considered to be medium.

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

9.4.63 Additional lighting associated with construction of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-010, Part 4.

Viewpoint 121.3.003: View north along the main tree avenue, Hartwell House

9.4.64 Construction activities will be visible in the middle ground of this narrow view framed by an avenue of trees, where plant and machinery associated with the earthworks will be apparent approximately 600m from the viewpoint. A temporary material stockpile area will also be visible at the end of the framed view approximately 900m from the viewpoint. The construction of the Footpath SBH/32 overbridge, the Bridleway SBH/2 overbridge and the Thame Valley viaduct and vegetation removal will be screened by the avenue of mature trees in the foreground and middle ground. However, construction activities will be incongruous with the existing view and the magnitude of change is considered to be high.

9.4.65 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 122.3.001: View south-west from PRoW (Footpath SBH/32) within Aylesbury Park Golf Club, Aylesbury

9.4.66 Construction activities will be openly visible in both the foreground and middle ground of this view. Plant and machinery associated with earthworks will be clearly evident, particularly during the course of altering the landform in the direct field of view in front of the woodland approximately 150m from the viewpoint. Furthermore, the plant and machinery associated with the construction of the elevated Footpath SBH/32 overbridge to the right of the view immediately adjacent to the viewpoint will also be clearly evident. The removal of vegetation and the alteration of land use will also severely disrupt the composition of the view, whilst temporary material stockpiles will also be visible, in front of the Proposed Scheme. As a result, the magnitude of change is considered to be high.

9.4.67 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

Viewpoint 123.2.001: View north-east from Whaddon Hill Farm, Lower Hartwell

9.4.68 To the left of this view (approximately 750m from the viewpoint) construction activities associated with the Thame Valley viaduct will be clearly visible, as will the earthworks to the west of Putlowes Farm and the creation of the Putlowes accommodation overbridge where the Thame Valley viaduct satellite compound will be prominent. Plant and machinery will also be visible across the majority of the middle ground associated with the creation of a cutting. To the right of the view, mitigation earthworks and the removal of mature woodland vegetation will also be clearly visible (approximately 400m from the viewpoint). These activities will be incongruous and the loss of mature vegetation will also result in an alteration in the view, opening up views beyond towards the urban edge of Aylesbury. On this basis, the magnitude of change is considered to be high.

9.4.69 The high magnitude of change, assessed alongside the high sensitivity of the receptor, will result in a major adverse effect.

9.4.70 Additional lighting associated with the Thame Valley viaduct satellite compound will perceptibly increase the extent of lighting in the middle ground of the view. On this basis, the magnitude of change to this receptor at night-time is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 123.3.001: View north-east from the Midshires Way, North Bucks Way and Thame Valley Walk PRoW (Bridleway SBH/2)

9.4.71 Construction activities associated with the Proposed Scheme will be visible within the context of a farmed landscape in the middle ground of the view (approximately 650m from the viewpoint) with some existing industrial activity visible in the background beyond. Plant and machinery associated with the Thame Valley viaduct and earthworks will be partially screened by the intervening vegetation in the foreground and middle ground. The Thame Valley viaduct satellite compound will be visible to the left of the view in the middle ground, albeit also partially screened by the intervening

vegetation running alongside the River Thame. These activities will be incongruous with the existing view, albeit intermittently visible. On this basis, the magnitude of change is considered to be medium.

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

Viewpoint 123.3.002: View north from the Thame Valley Walk PRoW (Bridleway SBH/2)

9.4.73 Construction activities associated with the formation of a cutting in the foreground of the view (approximately 50m from the viewpoint) and construction of a flood attenuation area and the Thame Valley viaduct will be clearly visible in the middle ground of view (approximately 300m from the viewpoint). These construction activities will necessitate the removal of some mature trees and scrub that will be discernible but not immediately apparent in the view. Temporary material stockpile areas will also be visible either side of the Proposed Scheme in the foreground of the view. These activities will be incongruous with the existing view and in combination with the proximity of the receptor, will result in a magnitude of change considered to be high.

9.4.74 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 124.3.001: View west from the Thame Valley Walk PRoW (Bridleway SBH/2)

9.4.75 The composition of this view will be substantially altered as a result of construction activities in the immediate vicinity of the viewpoint. Vegetation removal will result in a much more open view across grassland. Construction activities associated with the creation of the Bridleway SBH/2 overbridge in the centre of the view and in proximity to the viewpoint (approximately 20m distant) will be dominant. As a result of vegetation removal, construction activities will be visible to the left of the view, in front of which temporary material stockpile areas will be visible in the middle ground. The construction of the Thame Valley viaduct in the background of the view will be partially visible beyond the construction of the Bridleway SBH/2 overbridge in the foreground of the view. Given these substantial changes, the magnitude of change is considered to be high.

9.4.76 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 126.2.001: View west from Putlowes

9.4.77 Construction activities across the extent of this view (approximately 100m from the viewpoint) will be prominent. In particular, the earthworks required for the construction of the Putlowes accommodation overbridge will break the skyline, as will the plant and machinery associated with the creation of a cutting in the middle ground, restricting views towards the Eythrope Estate that forms the backdrop to the view. To the left of the view, the Thame Valley viaduct satellite compound will be apparent, as will temporary material stockpile areas along the length of the Proposed

Scheme. Given the scale and proximity of construction activities that will be incongruous with the existing view, the magnitude of change is considered to be high.

9.4.78 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.79 Additional lighting associated with the Thame Valley viaduct satellite compound will increase the extent of lighting in the view. On this basis, the magnitude of change at night-time is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 128.3.001: View west from PRoW (Bridleway FMA/1), Fleet Marston

9.4.80 Plant and machinery associated with the earthworks and vegetation removal will be clearly visible in the foreground of this view (approximately 130m from the viewpoint). Large scale plant and machinery within the pasture to the left and centre of the view will obstruct views beyond towards the Waddesdon Hill area in the background. The construction activities associated with the provision of the Bridleway FMA/1 accommodation overbridge and earthworks will also be partially screened by a hedgerow in the foreground to the right of this view in the middle ground. Temporary material stockpile areas will be visible in front of the Proposed Scheme in the middle ground of the view. Overall, the magnitude of change is considered to be high.

9.4.81 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

Viewpoint 129.2.001: View east from Cranwell Farm, Fleet Marston

9.4.82 Construction activities including the removal of vegetation associated with the construction of the A41 Bicester Road realignment will be clearly visible to the left of this view (approximately 170m from the viewpoint) in the middle ground. The A41 Bicester Road embankment main compound and the Putlowes auto-transformer station (located within the adjacent Waddesdon and Quainton CFA12) will lie adjacent. Views of construction activities related to the Proposed Scheme will be partly screened by the hedgerows bounding the arable field in the foreground of the view. To the right of the view, plant and machinery associated with the construction of the Bridleway FMA/1 accommodation overbridge will be visible and will restrict views beyond towards Wendover Woods in the background. A temporary material stockpile area will be visible behind the route in the centre of the view. The loss of key features in the view, including mature vegetation and the prominence of intense construction activities incongruous with the existing view in proximity to the viewpoint will result in a high magnitude of change.

9.4.83 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.84 Additional lighting associated with the A41 Bicester Road embankment main compound will increase the extent of lighting in the middle ground of the view. Therefore, the magnitude of change at night-time is considered to be medium, resulting in a moderate adverse effect.

Viewpoint 129.2.002: View east from Volvere, Fleet Marston

9.4.85 Construction activities will be clearly visible across the extent of this view (approximately 600m from the viewpoint) in the middle ground. Plant and machinery associated with the construction of the Bridleway FMA/1 accommodation overbridge, the A41 Bicester Road realignment, the Putlowes auto-transformer station (CFA12) and the A41 Bicester Road embankment main compound will be prominent to the left of the view. The construction of the Thame Valley viaduct will be barely visible in the background to the right of the view. The removal of mature vegetation along the length of the route will be apparent, as will plant and machinery constructing earthworks, laying track and erecting the overhead line equipment. A temporary material stockpile will be visible beyond the route. Retained vegetation in the foreground and middle ground will provide a limited degree of screening. Overall, the magnitude of change is considered to be high.

9.4.86 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.87 Lighting associated with the A41 Bicester Road embankment main compound will increase the extent of lighting in the middle ground of the view. To the right of the view, lighting associated with the Thame Valley viaduct satellite compound will also be visible, adding to the extent of sky glow from Aylesbury. On this basis, the magnitude of change at night is considered to be high, resulting in a major adverse effect.

Viewpoint 129.2.003: View north-east from Coneyhill Cottages, Eythrope

9.4.88 Various construction activities will be visible across the breadth of this view (approximately 1.1km from the viewpoint) in the middle ground within the lower-lying clay vale. Plant and machinery involved with earthworks, vegetation removal, topsoil stripping and construction of the viaduct, the Putlowes accommodation ovebridge, the Bridleway FMA/1 accommodation overbridge and the A41 Bicester Road realignment will be visible beyond the vegetation in the foreground, with construction of the route prominent. Although not breaking the skyline in the view, plant and machinery will obstruct views towards the background. Construction activities associated with the creation of the Putlowes auto-transformer station (CFA12) will be visible to the left of the view, as will the A41 Bicester Road embankment main compound. Temporary material stockpiles will be intermittently visible along the length of the Proposed Scheme. These incongruous construction activities will be visible across a large proportion of this panoramic view. This, in combination with the loss of features in the landscape, will result in a magnitude of change that is considered to be high.

9.4.89 The high magnitude of change, assessed alongside the high sensitivity of the receptor will result in a major adverse effect.

9.4.90 Lighting associated with the A41 Bicester Road embankment main compound will increase the extent of lighting in the middle ground of the view. To the right of the view, lighting associated with the Thame Valley viaduct satellite compound will be visible, compounding the extent of sky glow from Aylesbury. On this basis, the magnitude of change at night-time is considered to be high, resulting in major adverse effects.

Viewpoint 129.3.001: View north from the Midshires Way and Swans Way PRoW (Bridleway WAD/22), Waddesdon Hill

9.4.91 The view of the Proposed Scheme from this location during construction is illustrated on the photomontage shown in Figure LV-01-191 (Volume 2, CFA11 Map Book).

9.4.92 Construction activities associated with the A41 Bicester Road realignment will be visible at the foot of the slope in the middle ground (approximately 900m from the viewpoint), within a generally flat farmed landscape setting. Earthworks will be clearly visible along much of the valley bottom, in particular where the Proposed Scheme will be in cutting. Temporary material stockpile areas will also be visible along the length of the Proposed Scheme, in addition to visibility of the A41 Bicester Road roadhead (CFA12) to the right of the view and the Blackgrove Road roadhead (CFA12) to the left of the view. Given these activities that will be incongruous with the existing panoramic view, albeit approximately 900m from the viewpoint, and the loss of key features, including mature vegetation, the magnitude of change is considered to be medium.

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

Viewpoint 130.2.001: View west from Fleet Marston Farm, Fleet Marston

9.4.94 The removal of mature vegetation in the middle ground of this view (approximately 530m from the viewpoint) will be apparent from this location and will result in the partial loss of key features in the view. Plant and machinery associated with the construction of the Bridleway FMA/1 accommodation overbridge will also be apparent and will partially obstruct views towards the backdrop of Eythrope Estate. A temporary material stockpile area will be visible in the middle ground of the view, in front of the route. The foreground of the view will not be altered. On this basis the magnitude of change is considered to be medium.

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

9.4.96 Additional lighting associated with construction of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-010, Part 4.

Viewpoint 131.3.001: View north-east from the North Bucks Way, Aylesbury Ring, Bernwood Jubilee Way and Midshires Way PRoW (Footpath WAD/7B), Waddesdon Hill

9.4.97 Construction activities will be clearly visible within the centre of this elevated long-distance view (approximately 1.2km from the viewpoint). Tall plant and machinery associated with the construction of the A41 Bicester Road realignment will be most apparent, with the A41 Bicester Road roadhead (CFA12) and the Blackgrove Road roadhead (CFA12) also visible in a generally flat farmed landscape setting.

9.4.98 Given the substantial changes that will arise as a result of the addition of new plant and machinery and the removal of vegetation that will be in the direct field of this open view, albeit at a considerable distance from the viewpoint, the magnitude of change is considered to be medium.

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

Cumulative effects

9.4.100 Section 2.1 and Volume 5: Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the construction of the Proposed Scheme. There are no known future developments that are assumed to be under construction or operation at the same time as the Proposed Scheme that will result in a consequential cumulative effect on LCA or viewpoints. Cumulative developments that have been considered in the assessment are shown on Maps CT-13-021 to CT-13-025 (Volume 5, Cross Topic Appendix 1 Map Book).

Other mitigation measures

9.4.101 To further reduce the significant effects described above, consideration of where planting can be established early in the construction programme will be given during the detail design stage. This may include consideration of early planting in ecological mitigation sites which would have the additional benefit of providing some visual screening. However, not all landscape and visual effects can be practicably mitigated due to the visibility of construction activity and the sensitivity of surrounding receptors. Therefore, no other mitigation measures are considered practicable during construction.

Summary of likely residual significant effects

9.4.102 These effects will be temporary and reversible in nature lasting only for the duration of the construction works. Any residual effects will generally arise from the widespread presence of construction activity and construction plant within the landscape and viewed from surrounding residential receptors, and users of PRoW and main roads within the study area.

9.5 Permanent effects arising during operation

9.5.1 Specific elements of the Proposed Scheme that have been taken into account in determining the effects on landscape and visual receptors include the following , ordered from south to north:

- the new A4010 Stoke Mandeville bypass;
- the Princes Risborough to Aylesbury rail overbridge;
- the A418 Oxford Road overbridge;
- the Thame Valley viaduct;
- the A41 Bicester Road realignment;
- the presence of earthworks along the Proposed Scheme requiring cut/fill, vegetation removal, noise fence barriers, balancing ponds and modifications to the landform; and
- the presence of high speed passing trains and overhead line equipment.

Avoidance and mitigation measures

9.5.2 The operational assessment of impacts and effects is based on year 1 (2026), year 15 (2041) and year 60 (2086) of the Proposed Scheme. A process of iterative design and assessment has been employed to avoid or reduce adverse effects during the operation of the Proposed Scheme. Measures that have been incorporated into the design of the Proposed Scheme include:

- embankments and cuttings, both for the route of the Proposed Scheme and highway realignments, will be shaped so as to integrate the Proposed Scheme into the character of the surrounding landscape. Planting will reflect tree and shrub species native to the landscape;
- where it is considered that a noise fence barrier will create a visual impact on neighbouring residential properties a landscape bund will be provided where reasonably practicable;
- balancing ponds will be integrated into the landscape to alleviate flooding and also provide opportunities for biodiversity; and
- planting, including native broad-leaved woodland, shrubs and hedgerows, will be implemented along various sections of the Proposed Scheme. This will screen the Proposed Scheme from neighbouring residential properties and users of adjacent PRoW and to aid integration of the Proposed Scheme into the landscape. In the vicinity of Hartwell House the proposed planting will be in-keeping with the existing character of the area, including the reinstatement of the tree avenue. Selection of species will take into account possible climate change impacts associated with the quality and availability of water and the potential increase in pests and diseases.

9.5.3 These avoidance and mitigation measures have been taken into account within the assessment of the operational effects.

Assessment of impacts and effects

9.5.4 The likely significant effects on the landscape character and viewpoints in operation will arise from:

- new engineered landforms cutting across the existing landscape;
- the presence of a new viaduct of approximately 6m height and 1km length with associated infrastructure;
- the presence of noise fence barriers that will create a man-made linear feature;
- the permanent severance of land;
- the presence of highway and rail infrastructure in the rural environment, including road bridges;
- the presence of overhead line equipment; and
- the presence of regular high speed trains.

9.5.5 At a number of locations, views of the Proposed Scheme will be obscured by the intervening topography, intervening hedgerows and trees and the screening effects achieved by the Proposed Scheme in cutting and mitigation earthworks. Effects will be further reduced over time as the mitigation planting matures.

Landscape assessment

9.5.6 This section describes the significant effects on LCA during year 1, year 15 and year 60 of operation. Effects that will not be significant for LCA are presented in Volume 5: Appendix LV-001-011 Part 4.

9.5.7 The assessment of effects in year 15 assume proposed planting has grown by approximately 450mm a year (i.e. trees will be 7-7.5m high). The assessment of effects in year 60 assumes all planting has reached its fully mature height.

Stoke Mandeville Vale LCA

9.5.8 The Proposed Scheme will pass through this LCA between the former site of the Church of St Mary's and graveyard and the Princes Risborough to Aylesbury Line for approximately 2.5km. The presence of the Proposed Scheme and associated road and PRoW realignments will directly affect this landscape in year 1 of operation. Landscape impacts of the Proposed Scheme will include:

- engineered landforms of steep slopes cutting across the natural landform, incongruous in the context of the landscape;
- presence of overhead line equipment and regular trains that although already present within the context of the Princes Risborough to Aylesbury Line, introduces additional infrastructure within a largely rural landscape;
- presence of the maintenance loop;

- presence of the new A4010 Stoke Mandeville bypass;
- presence of the Princes Risborough to Aylesbury rail overbridge;
- presence of PRoW crossings; and
- presence of noise fence barriers as a distinct linear feature, contrasting with the natural landscape.

9.5.9 There will be a noticeable reduction in tranquillity due to the visual intrusion in the immediate vicinity of the Proposed Scheme. However, this will reduce over the wider landscape with increasing distance. Direct impacts on landscape components within the LCA will occur within a small proportion of the area such as the loss of hedgerow vegetation and severance of agricultural land. The key characteristics of the landscape will for the most part be retained such as the openness of views towards the wooded chalk escarpment that forms the wider landscape setting to this LCA.

9.5.10 Due to these changes that will be incongruous with the character of the area, the magnitude of change is considered to be medium in year 1 of operation.

9.5.11 The medium magnitude of change, assessed alongside the low sensitivity of the character area will result in a moderate adverse effect in year 1 of operation.

9.5.12 By year 15 and beyond to year 60 of operation, the maturity of planting will further integrate the Proposed Scheme into the landscape resulting in an effect that is not considered to be significant. This is reported in Volume 5: Appendix LV-001-011 Part 4.

Haddenham Vale LCA

9.5.13 The Proposed Scheme will pass through the Haddenham Vale LCA between the Princes Risborough to Aylesbury Line and the A418 Oxford Road for approximately 2.9km. The Proposed Scheme will form prominent elements in the immediate vicinity of this generally flat landscape and will be incongruous to the character of the area given the absence of major development. Landscape impacts of the Proposed Scheme will include:

- alterations to the landform including steep slopes cutting across the natural largely flat landform, incongruous in the context of the landscape. The mitigation earthworks, whilst designed to offset or reduce the effects of the Proposed Scheme in the longer term, may in the early stages of operation be apparent as a bare soiled surface;
- presence of overhead line equipment and regular trains that although already present within the context of the Princes Risborough to Aylesbury Line, introduces additional infrastructure within a largely rural landscape;
- presence of PRoW crossings;
- presence of the A418 Oxford Road overbridge; and
- presence of noise fence barriers as a distinct linear feature, contrasting with the natural landscape.

9.5.14 The presence of the Proposed Scheme in the landscape will result in a noticeable reduction in tranquillity through visual intrusion in the landscape to the east of Bishopstone. Further from the route, any reduction in the level of tranquillity is unlikely to be perceptible due to the abundance of intervening vegetation screening views towards the Proposed Scheme.

9.5.15 Due to these changes incongruous with the character of the area, the magnitude of change is considered to be medium in year 1 of operation.

9.5.16 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 1 of operation.

9.5.17 By year 15 of operation, farming activities will have become well established on land previously used for construction activities and mitigation earthworks, to the extent that this land will be indistinguishable from the adjacent farmland. The mitigation earthworks will be effective in the years leading up to and including year 15 as this will blend into the existing surrounding landscape. Furthermore, planting will have established to achieve greater landscape integration of the Proposed Scheme into the rural landscape, including through:

- reducing the influence of engineered landforms;
- better integrating the A418 Oxford Road realignment;
- increasing connectivity in the landscape as reinstated hedgerows mature; and
- partially screening the overhead line equipment, high speed trains, and noise fence barriers.

9.5.18 However, due to the continued prominence of the Proposed Scheme in an otherwise flat landscape, the alterations to the landform and the changes to the tranquillity of the area, the magnitude of change will remain medium in year 15 of operation.

9.5.19 The medium magnitude of change, assessed alongside the medium sensitivity of the character area, will result in a moderate adverse effect in year 15 of operation.

9.5.20 By year 60 of operation, the maturity of planting will further integrate the Proposed Scheme into the landscape resulting in an effect that is not considered to be significant. This is reported in Volume 5: Appendix LV-001-011 Part 4.

Hartwell House and Golf Course LCA

9.5.21 The Proposed Scheme will pass through the Hartwell House and Golf Course LCA from the A418 Oxford Road to the Thame Valley Walk PRoW (Bridleway SBH/2 overbridge) for approximately 1.7km, both in a cutting with a depth of approximately 8m and on embankment with a height of up to 4m. The presence of the Proposed Scheme will affect the character of the enclosed, historic parkland setting. Landscape impacts of the Proposed Scheme will include:

- engineered landforms across a relatively flat landscape;
- presence of overhead line equipment, regular high speed trains, and noise fence barriers, introducing additional infrastructure within an historic parkland

landscape context;

- severance of the historic tree avenue;
- severance of the Aylesbury Park Golf Course; and
- presence of PRoW crossings.

9.5.22 The tranquillity of this parkland landscape will be affected during year 1 of operation of the Proposed Scheme. Impacts will arise through visual intrusion from the more prominent elements of the route such as earthworks, embankments and the reduction in enclosure as a result of vegetation removed during construction. The perception of the parkland as being quiet and remote from development will be diminished. Therefore, the magnitude of change is considered to be high in year 1 of operation.

9.5.23 The high magnitude of change, assessed alongside the high sensitivity of the character area, will result in a major adverse effect in year 1 of operation.

9.5.24 By year 15 of operation, planting will have established to achieve greater landscape integration of the Proposed Scheme into the parkland landscape, including through:

- reducing the influence of engineered landforms;
- better integrating the PRoW crossings;
- providing increased connectivity in the landscape through woodland planting;
- improving the integrity and condition of the historic tree avenue by reintroducing trees in the designed landscape through filling gaps in the degraded avenue; and
- partially screening the overhead line equipment, noise fence barriers and high speed trains.

9.5.25 However, due to the continued prominence of the Proposed Scheme within a Grade II* registered park and garden (RPG), the impact upon the setting of Hartwell House, the permanent loss of woodland vegetation and grassland, the alterations to the landform and the changes to the tranquillity of the area, the magnitude of change will remain high in year 15 of operation.

9.5.26 The high magnitude of change, assessed alongside the high sensitivity of the character area, will result in a major adverse effect in year 15 of operation.

9.5.27 By year 60 of operation, the maturity of planting will better integrate the Proposed Scheme into the landscape. The magnitude of change will be medium in year 60 of operation.

9.5.28 The medium magnitude of change, assessed alongside the high sensitivity of the character area, will result in a moderate adverse effect in year 60 of operation.

Fleet Marston Vale LCA

9.5.29 The Proposed Scheme will pass through the Fleet Marston Vale LCA from the Thame Valley Walk PRoW (Bridleway SBH/2 overbridge) towards Fleet Marston for approximately 3km. The linear aspect of the Proposed Scheme will represent a prominent new feature in the landscape, although mitigation earthworks along its length, together with agricultural reinstatement, will help integrate the Proposed Scheme into the landscape. Landscape impacts of the Proposed Scheme will include:

- engineered landforms across a relatively flat landscape;
- presence of overhead line equipment and regular high speed trains, introducing additional infrastructure within a largely rural landscape;
- presence of the Thame Valley viaduct;
- presence of the A41 Bicester Road realignment;
- presence of PRoW crossings; and
- presence of noise fence barriers as a distinct linear feature, contrasting with the natural landform.

9.5.30 During year 1 of operation, the noise and visual intrusion of the Proposed Scheme will affect a large extent of this large scale, open landscape, reducing tranquillity.

9.5.31 Therefore, the magnitude of change is considered to be medium in year 1 of operation.

9.5.32 The medium magnitude of change, assessed alongside the low sensitivity of the character area, will result in a moderate adverse effect in year 1 of operation.

9.5.33 By year 15 and beyond to year 60 of operation, the maturity of planting will further integrate the Proposed Scheme into the landscape resulting in an effect that is not considered to be significant. This is reported in Volume 5: Appendix LV-001-011 Part 4.

Visual assessment

9.5.34 This section describes the significant effects on visual receptors during year 1, year 15 and year 60 of operation. Effects that are considered to not be significant on visual receptors are presented in Volume 5: Appendix LV-001-011 Part 4.

9.5.35 For each viewpoint the following assessments have been undertaken:

- effects during winter of year 1 of operation;
- effects during summer of year 1 of operation;
- effects during summer of year 15 of operation; and
- effects during summer of year 60 of operation.

9.5.36 Where significant effects have been identified, an assessment of effects at night-time arising from additional lighting has also been undertaken.

9.5.37 The number identifies the viewpoint locations that are shown on Maps LV-04-038 to LV-04-043 (Volume 2, CFA11 Map Book). In each case, the middle number (xxx.**x**.xxx) identifies the type of receptor that is present in this area – 2: Residential, 3: Recreational, 4: Transport, 6: Employment, 7: Active Sports.

9.5.38 Where a viewpoint may represent multiple types of receptor, the assessment is based on the most sensitive receptors. Effects on other receptor types with a lower sensitivity may be lower than those reported.

9.5.39 The view of the Proposed Scheme during the winter of year 1 of operation from viewpoint 115.3.001 (illustrated in the photomontage shown in Figure LV-01-063), viewpoint 121.3.003 (illustrated in the photomontage shown in Figure LV-01-067) and viewpoint 129.2.003 (illustrated in the photomontage shown in Figure LV-01-071), will not be significantly affected as the Proposed Scheme will be partially screened by the intervening vegetation or landform from these locations. The view of the Proposed Scheme during year 15 of operation from viewpoint 118.3.002 (illustrated in the photomontage shown in Figure LV-01-236) and viewpoint 129.3.001 (illustrated in the photomontage shown in Figure LV-01-237), will not be significantly affected as a result of maturing vegetation established as part of the Proposed Scheme, providing additional screening and further integrating the Proposed Scheme into the landscape.

Viewpoint 111.2.001: View east from dwellings on Old Risborough Road

9.5.40 The Proposed Scheme will be clearly visible extending across the pasture in the foreground and middle ground of the view on embankment. The overhead line equipment and noise fence barriers will be apparent in the foreground (approximately 70m from the viewpoint) at ground level and from first floor windows. In addition, the introduction of the Risborough Road underpass will also be apparent. Vegetation removed from the A4010 Risborough Road and Old Risborough Road during construction will allow more open views towards Whitethorn Farm in the middle ground, beyond the Proposed Scheme. Given the substantial changes that will arise as a result of the addition of new features incongruous with the existing view in proximity to the viewpoint, the magnitude of change is considered to be high.

9.5.41 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in the winter of year 1 of operation.

9.5.42 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.43 By year 15 and beyond to year 60 of operation, although reinstated planting will have matured, providing some additional screening, the composition of the view will remain largely unaltered. Therefore effects will be unchanged and remain significant.

9.5.44 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 112.2.002: View south-west from Stoke House, Stoke Mandeville

9.5.45 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-60 (Volume 2, CFA11 Map Book). The impact on the setting of this receptor as a cultural heritage asset is detailed in Section 6 of this report.

9.5.46 The Proposed Scheme in year 1 of operation will be clearly visible in this view (approximately 170m from the viewpoint), including a prominent new pylon in the centre of the view beyond the route. The route, extending across the view on embankment, will be prominent from both ground and first floor windows. To the left of the view, young planting will not have grown sufficiently to screen views towards the maintenance loop to the left of the view. The absence of vegetation, removed during construction, will be apparent across the extent of the view in the middle ground, partially opening up views towards Risborough Road. On this basis, the magnitude of change is considered to be medium.

9.5.47 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.48 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.49 By year 15 of operation, although planting will have matured to provide some additional screening of the route on embankment, elements of the Proposed Scheme will remain clearly visible including noise fence barriers, the pylon, the overhead line equipment and passing high speed trains. Therefore effects will be unchanged and remain significant.

9.5.50 By year 60, planting will have matured further and will provide additional screening and better integrate the Proposed Scheme into the view. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.51 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 112.4.001: View west from A4010 Risborough Road, Stoke Mandeville

9.5.52 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-61 (Volume 2, CFA11 Map Book).

9.5.53 This view will be substantially altered as the Proposed Scheme will extend across the view, cutting across the line of Risborough Road (approximately 100m from the viewpoint). The Proposed Scheme will be on an embankment with noise fence barriers and overhead line equipment prominent. The absence of vegetation, removed during construction, will still be apparent and will partially open up views beyond towards pylons in the background. The addition of these new features will be incongruous with the existing view and in proximity to the viewpoint and therefore the magnitude of change is considered to be high.

9.5.54 The high magnitude of change assessed alongside the low sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.55 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.56 By year 15 and beyond to year 60 of operation, although reinstated planting will have established and better integrate the Proposed Scheme into the landscape with in the view, the noise fence barriers and overhead line equipment will still be visible across a large extent of this view. Therefore the effects will be unchanged, and will remain significant.

Viewpoint 113.4.001: View east from Marsh Lane, Marsh

9.5.57 The foreground of this view will be substantially altered due to the introduction of the new A4010 Stoke Mandeville bypass, with a new T-junction forming the central focus of the view (approximately 50m from the viewpoint). The lack of intervening vegetation will result in open views, partially restricted by the mitigation earthwork, towards the urban edge of Stoke Mandeville. Overhead line equipment along the Proposed Scheme in the middle ground will be visible in the adjacent arable fields. The planting proposed between the new A4010 Stoke Mandeville bypass and the Proposed Scheme will not have matured sufficiently to screen views. Overall, the magnitude of change is considered to be high.

9.5.58 The high magnitude of change assessed alongside the medium sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.59 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.60 By year 15 and beyond to year 60 of operation, planting will have established and will provide some degree of screening, better integrating the Proposed Scheme and the new A4010 Stoke Mandeville bypass into the landscape within the view. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

Viewpoint 114.2.002: View west from Moat Farm, Stoke Mandeville

9.5.61 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-62 (Volume 2, CFA11 Map Book).

9.5.62 The Proposed Scheme will appear as a new feature in the landscape in the middle ground of this view (approximately 170m from the viewpoint) in the winter of year 1 of operation. To the left of the view the Footpath SMA/9 accommodation overbridge will be a discernible new feature in the view. The route in cutting will be partially screened by the intervening landform and mitigation earthworks across the extent of the view. Proposed planting will still be young and the overhead line equipment will remain visible. From first floor levels, the new A4010 Stoke Mandeville bypass and the elevated Princes Risborough to Aylesbury Line will also be visible. The absence of vegetation, removed from Marsh Lane during construction, will still be apparent. Overall the magnitude of change is considered to be medium.

9.5.63 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.64 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.65 By year 15 and beyond to year 60 of operation, planting will have established and will provide additional screening towards the Proposed Scheme, filtering views of the overhead line equipment. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.66 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 116.3.001: View south-west from the Round Aylesbury Walk PRoW (Footpath SMA/16), Southcourt

9.5.67 The Proposed Scheme at track level will be screened by the existing landform as the route will be in cutting but the overhead line equipment will be visible in the foreground approximately 100m away. The elevated Footpath SMA/16 accommodation overbridge will be visible in the view to the right and will draw the viewers' attention. Views towards the wooded chalk escarpment will not be obscured by the Proposed Scheme. Given these changes, the magnitude of change is considered to be medium.

9.5.68 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.69 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.70 By year 15 and beyond to year 60 of operation, the elevated Footpath SMA/16 accommodation overbridge will be better integrated into the landscape in the view as the landform will have taken on a similar appearance to that formerly. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

Viewpoint 117.3.001: View east from the Midshires Way PRoW (Bridleway SBH/19), Bishopstone

9.5.71 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-64 (Volume 2, CFA11 Map Book).

9.5.72 During the winter of year 1 of operation, views of the Proposed Scheme will be attainable in the middle ground in the centre of this view (approximately 550m from the viewpoint), although mitigation earthworks will partially screen views of the passing trains and noise fence barriers. To the left and right of the view, vegetation in the foreground will provide screening towards the Proposed Scheme, whereby views of the elevated Bridleway SBH/19 overbridge and the Footpath SBH/27 overbridge will not be attainable. Given the intermittent visibility of the Proposed Scheme in the view, the magnitude of change is considered to be medium.

9.5.73 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.74 Woodland and hedgerow vegetation in the foreground and middle ground of the view will provide additional screening towards the Proposed Scheme during the summer of year 1 of operation. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.75 By year 15 and beyond to year 60 of operation, existing and reinstated planting will have matured and farming activities will have resumed. The landscape will largely take the appearance of that formerly such that the effects are not considered to be significant. These are also reported in Volume 5: Appendix LV-001-011 Part 4.

Viewpoint 118.3.002: View west from the Round Aylesbury Walk PRoW (Footpath SBH/27), Southcourt

9.5.76 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-65 (Volume 2, CFA11 Map Book).

9.5.77 Views of the Proposed Scheme will be attainable through gaps in the hedgerow in the middle ground. The overhead line equipment will be for the most part visible above the mitigation earthworks and above the line of the hedgerow in front of the Proposed Scheme. The Footpath SBH/27 overbridge in the centre of the view in the middle ground will be clearly visible and will appear to be out of character in a predominantly flat landscape (approximately 320m from the viewpoint), interrupting the farmland skyline. Views towards the A418 Oxford Road realignment will be screened by vegetation in the middle ground. Given the changes that will arise as a result of the addition of new features in proximity to the viewpoint, the magnitude of change is considered to be medium.

9.5.78 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.79 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.80 The view of the Proposed Scheme in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-236 (Volume 2, CFA11 Map Book).

9.5.81 By year 15 and beyond to year 60 of operation, reinstated and existing planting will have matured and will better integrate the Proposed Scheme into the landscape, screening views towards the line of the route and the Footpath SBH/27 overbridge. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

Viewpoint 119.2.001: View east from dwellings on Mayflower Close, Hartwell

9.5.82 The Proposed Scheme in the winter of year 1 of operation will appear as a new feature in the landscape and in particular the A418 Oxford Road realignment will appear as being dominant in the foreground and middle ground of the near-distance view (approximately 200m from the viewpoint), limiting views beyond. Views of the overhead line equipment along the route will also be attainable in the middle ground of the view, albeit partially screened by the mitigation earthworks. The Sedrup express feeder auto-transformer station will also be screened by the intervening landform and mitigation earthworks to the right of the A418 Oxford Road realignment. Planting proposals at this stage will still be in a young state and will provide limited screening effect from both ground and first floor levels. Given the substantial changes that will arise as a result of the addition of new features incongruous with the existing view in proximity to the viewpoint, the magnitude of change is considered to be high.

9.5.83 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in the winter of year 1 of operation.

9.5.84 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.85 By the summer of year 15 of operation reinstated and proposed planting will have matured and will better integrate the Proposed Scheme into the landscape. The A418 Oxford Road realignment will be partially screened by the proposed planting. Where landform alterations will have occurred, farming practices will have resumed and the land will have taken on a similar appearance to that formerly. The magnitude of change is considered to be medium, resulting in a moderate adverse effect.

9.5.86 By year 60 of operation the Proposed Scheme will be further integrated into the landscape as a result of maturing planting proposals, improving the composition of the view. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.87 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 121.3.003: View north along the main tree avenue, Hartwell House

9.5.88 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-67 (Volume 2, CFA11 Map Book). The impact on the setting of this receptor as a cultural heritage asset is detailed in Section 6 of this report.

9.5.89 In winter of year 1 of operation the Proposed Scheme will not be discernibly visible across the majority of the view therefore the effects will not be significant and are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.90 In summer of year 1 of operation, effects will be unchanged and are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.91 By the summer of year 15 of operation, planting proposals will have established and will slightly improve the composition of the view; however these effects are not considered to be significant and are therefore reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.92 By year 60 of operation, planting proposals associated with the historic tree avenue will have matured and will greatly improve the composition of the view, aiding the receptors understanding and interpretation of the historic landscape. The magnitude of change is considered to be medium, resulting in a moderate beneficial effect.

Viewpoint 122.3.001: View south-west from PRoW (Footpath SBH/32) within Aylesbury Park Golf Club, Aylesbury

9.5.93 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-68 (Volume 2, CFA11 Map Book).

9.5.94 The Proposed Scheme will result in the severance of the Aylesbury Park Golf Club grassland. Mature vegetation and park grassland losses associated with the construction of the Proposed Scheme will be apparent within this view (approximately 160m) in the foreground, middle ground and background. The Proposed Scheme at this location will be on an embankment, with both noise fence barriers and overhead line equipment clearly visible in the view. The elevated Footpath SBH/32 overbridge to the right of the view will also be clearly visible to the viewer. Mitigation planting beyond the Proposed Scheme will still be in a young state. Given the substantial changes which will arise as a result of the addition of new features incongruous with the existing view in proximity to the viewpoint, the magnitude of change is considered to be high.

9.5.95 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in the winter of year 1 of operation.

9.5.96 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.97 By year 15 and beyond to year 60 of operation, the lack of intervening planting means effects will remain unchanged and are still considered significant.

Viewpoint 123.2.001: View north-east from Whaddon Hill Farm, Lower Hartwell

9.5.98 The Proposed Scheme will be visible across the majority of the middle ground in this view with the Thame Valley viaduct presenting as a discernible new feature in the view (approximately 750m from the viewpoint). A balancing pond will be visible in front of the abutment between the Thame Valley viaduct and the Proposed Scheme on embankment. To the left of this new feature the Putlowes accommodation overbridge will also be apparent and appear incongruous with the more gently undulating landscape. To the right of the view, the removal of mature woodland vegetation associated with the construction activities will be apparent, partially opening up views towards the Proposed Scheme in cutting with the Bridleway SBH/2 overbridge clearly visible as a new elevated feature in the view (approximately 450m from the viewpoint). Given the changes that will arise as a result of the addition of new features incongruous with the existing view, the magnitude of change is considered to be medium.

9.5.99 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.100 In summer of year 1 of operation, effects will be unchanged.

9.5.101 By the summer of year 15 of operation proposed planting in the vicinity of the Bridleway SBH/2 overbridge to the right of the view will have established and will better integrate the Proposed Scheme into the landscape, although the effects will remain unchanged.

9.5.102 By year 60 of operation, the proposed planting in the vicinity of the Bridleway SBH/2 overbridge will have matured further and will partially screen this elevated feature. The balancing pond in the vicinity of the Thame Valley viaduct will also have taken on a more natural appearance. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.103 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 123.3.002: View north from the Thame Valley Walk PRoW (Bridleway SBH/2)

9.5.104 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-69 (Volume 2, CFA11 Map Book).

9.5.105 In the winter of year 1 of operation, the Thame Valley viaduct in the middle ground extending to the background will appear as a conspicuous new feature in the landscape in this view (approximately 90m from the viewpoint). Although partially screened as the route will be in cutting, the overhead line equipment, noise fence barriers, high speed trains and fencing will be visible along the length of the route in both the foreground and middle ground of this view. Vegetation removal associated with the construction activities will also still be apparent. To the right of the view the elevated Bridleway SBH/2 overbridge will also be apparent, as will the track leading to this new elevated feature. Given the changes that will arise as a result of the addition of new features in proximity to the viewpoint, the magnitude of change is considered to be medium.

9.5.106 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.107 In summer of year 1 of operation, effects will be unchanged.

9.5.108 By year 15 and beyond to year 60 of operation proposed planting in the vicinity of the Bridleway SBH/2 overbridge will have matured and will slightly improve the composition of the view, however the effects will remain unaltered and are considered significant.

Viewpoint 124.3.001: View west from the Thame Valley Walk PRoW (Bridleway SBH/2)

9.5.109 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-70 (Volume 2, CFA11 Map Book).

9.5.110 During the winter of year 1 of operation, evidence of vegetation removed during the construction phase will still be clearly apparent in the foreground and middle ground of this view. In the centre of the view, the Bridleway SBH/2 overbridge will be prominent, appearing as a new elevated feature in the landscape (approximately 100m from the viewpoint). To the left of the view the Proposed Scheme will be in a cutting and therefore the overhead line equipment will be the main visible element together with noise fence barriers and high speed passing trains. Given the substantial changes that will arise as a result of the addition of new features incongruous with the existing view and the loss of mature vegetation, in proximity to the viewpoint, the magnitude of change is considered to be high.

9.5.111 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in the winter of year 1 of operation.

9.5.112 In summer of year 1 of operation, effects will be unchanged.

9.5.113 By year 15 of operation, proposed planting will have established and will better integrate the Proposed Scheme into the landscape. The route in cutting to the left of the view will be screened by planting whilst the Bridleway SBH/2 overbridge in the centre of the view will be partially screened. Therefore the magnitude of change is considered to be medium, giving rise to a moderate adverse effect in the summer of year 15 of operation.

9.5.114 By the summer of year 60 of operation the proposed planting will have matured and will further integrate the Proposed Scheme into the landscape and increase the sense of enclosure. This will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

Viewpoint 126.2.001: View west from Putlowes

9.5.115 The Proposed Scheme will extend across this view (approximately 150m from the viewpoint) and will be visible, albeit partially screened by mitigation earthworks, with noise fence barriers and overhead line equipment the main visible elements. The Putlowes accommodation overbridge to the left of the view will break the skyline and appear as a new feature within the landscape, restricting views across the valley landscape. Planting proposals to the right of the view will be in a young state and will not yet provide any degree of screening. Given the substantial changes that will arise as a result of the addition of new features incongruous with the existing view in proximity to the viewpoint, the magnitude of change is considered to be high.

9.5.116 The high magnitude of change assessed alongside the high sensitivity of the receptor will result in a major adverse effect in the winter of year 1 of operation.

9.5.117 In summer of year 1 of operation, effects will be unchanged.

9.5.118 By year 15 and beyond to year 60 of operation reinstated planting in the vicinity of the Putlowes accommodation overbridge to the left and mitigation planting copses to the right of the view will have matured and will partially screen and further integrate the Proposed Scheme into the landscape. Therefore the magnitude of change is considered to be medium, giving rise to a moderate adverse effect in the summer of year 15 and year 60 of operation which is still considered significant.

9.5.119 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 128.3.001: View west from PRoW (Bridleway FMA/1), Fleet Marston

9.5.120 During the winter of year 1 of operation the Proposed Scheme will be visible in the middle ground of this view (approximately 180m from the viewpoint) appearing as a new distinct linear feature in the landscape. Although partial screening will be afforded by the mitigation earthworks, the noise fence barriers and overhead line equipment will remain visible across the breadth of the view. Given the addition of a new feature that will appear incongruous in the existing view, the magnitude of change is considered to be medium.

9.5.121 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.122 In summer of year 1 of operation, effects will remain unchanged.

9.5.123 By year 15 and beyond to year 60 of operation, mitigation planting copses to the left of the view will have matured and will partially screen and better integrate the Proposed Scheme into the landscape. Mitigation earthworks will have also taken on a farmed appearance and will better integrate the Proposed Scheme into the landscape such that the effects are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

Viewpoint 129.2.001: View east from Cranwell Farm, Fleet Marston

9.5.124 In winter of year 1 of operation, vegetation losses associated with the construction phase will be apparent in this view. Although the existing hedgerow in the middle ground will partially screen views of the Proposed Scheme in the centre and right of the view (approximately 250m from the viewpoint), the overhead line equipment will be visible, as will the Bridleway FMA/1 accommodation overbridge to the right of the view. The A41 Bicester Road realignment will not be a discernible feature in the landscape to the left of the view in the middle ground. The Putlowes auto-transformer station (CFA12), located between the route and the A41 Bicester Road realignment, will be partially screened by the route on embankment.

9.5.125 Given the discernible changes which will arise as a result of the addition of new features incongruous with the existing view in proximity to the viewpoint, the magnitude of change is considered to be medium.

9.5.126 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.127 In summer of year 1 of operation, effects will be unchanged.

9.5.128 By the summer of year 15 of operation the mitigation earthworks will have taken on a farmed appearance and will better integrate the Proposed Scheme on embankment into the landscape. However, effects will remain unchanged.

9.5.129 By year 60 of operation proposed planting will have further matured and will better integrate the Proposed Scheme into the landscape, such that the effects are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.130 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 129.2.002: View east from Volvere, Fleet Marston

9.5.131 During the winter of year 1 of operation there will be a number of elements of the Proposed Scheme which will be visible in the middle ground of this view. Features, such as the Bridleway FMA/1 accommodation overbridge (approximately 700m from the viewpoint) and the Putlowes accommodation overbridge will be clearly visible and will restrict views beyond to the background of the view. Track level views are unlikely to be perceptible, given the distance from the observer, although views of overhead line equipment will be attainable. In addition, evidence of vegetation losses arising during the construction phases will be apparent. To the left of the view, the Putlowes auto-transformer station (CFA12) will be partially screened by the route on embankment. Given the noticeable changes which will arise as a result of the addition of new features in proximity to the viewpoint, the magnitude of change is considered to be medium.

9.5.132 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.133 In summer of year 1 of operation, additional screening afforded by intervening hedgerow vegetation will partially restrict the extent of the Proposed Scheme visible from this location. However, effects will remain unchanged.

9.5.134 By the summer of year 15 of operation the mitigation earthworks will have taken on a farmed appearance and will further integrate the Proposed Scheme on embankment into the landscape. Planting proposals will have established and will further integrate the Proposed Scheme into the landscape in this predominantly rural landscape setting. However, effects will remain unchanged.

9.5.135 By year 60 of operation proposed planting will have further matured and will further integrate the Proposed Scheme into the landscape. Given the distance of the viewpoint from the Proposed Scheme and the extent of screening afforded by intervening vegetation, such that the effects are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.136 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 129.3.001: View north from the Midshires Way and Swans Way PRoW (Bridleway WAD/22), Waddesdon Hill

9.5.137 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-72 (Volume 2, CFA11 Map Book).

9.5.138 During the winter of year 1 of operation, the A41 Bicester Road realignment will appear as a new distinct feature within this view (approximately 1.3km from the viewpoint). The route will be clearly visible along its length from this location, with the overhead line equipment most evident. Given the noticeable changes which will arise as a result of the addition of new features in the view, the magnitude of change is considered to be medium.

9.5.139 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.140 In summer of year 1 of operation, effects will be unchanged.

9.5.141 The view of the Proposed Scheme in the summer of year 15 of operation is illustrated on the photomontage shown in Figure LV-01-237 (Volume 2, CFA11 Map Book).

9.5.142 By year 15 and beyond to year 60 of operation reinstated and proposed planting adjacent to the A41 Bicester Road realignment will have matured and will better integrate the Proposed Scheme into the landscape, partially screening this feature. Given the distance of the viewpoint from the Proposed Scheme, such that the effects are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

Viewpoint 130.2.001: View west from Fleet Marston Farm, Fleet Marston

9.5.143 The view of the Proposed Scheme in the winter of year 1 of operation is illustrated on the photomontage shown in Figure LV-01-73 (Volume 2, CFA11 Map Book).

9.5.144 In the winter of year 1 of operation, a number of elements of the Proposed Scheme will be visible in the middle ground of this view. Elevated features, such as the Bridleway FMA/1 accommodation overbridge in the centre of the view, will be noticeably out of character in an immediately flat landscape setting and will be the main visible element. The Proposed Scheme will be on an embankment across the breadth of the view with the earthworks and overhead line equipment also clearly visible. Evidence of vegetation losses associated with the construction phase will also be apparent. Views towards the elevated landscape providing the backdrop to the view will be retained. Given that the new features introduced into the view will be perceived as a series of components visible in the middle ground, the magnitude of change is considered to be medium.

9.5.145 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.146 In summer of year 1 of operation, effects will be unchanged due to a lack of intervening vegetation.

9.5.147 By year 15 and beyond to year 60 of operation, the Proposed Scheme on embankment and the Bridleway FMA/1 accommodation overbridge will be apparent in the view, albeit seen against an elevated backdrop. The earthworks will have taken on a farmed appearance and in combination with the matured reinstated and proposed planting, will further integrate the Proposed Scheme into the landscape, such that the effects are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

9.5.148 Additional lighting associated with operation of the Proposed Scheme will result in effects that are not considered to be significant. These are reported in Volume 5: Appendix lv-001-010, Part 4.

Viewpoint 131.3.001: View north-east from the North Bucks Way, Aylesbury Ring, Bernwood Jubilee Way and Midshires Way PRoW (Footpath WAD/7B), Waddesdon Hill

9.5.149 The A41 Bicester Road realignment will be immediately recognisable as new feature in an otherwise predominantly farmed valley setting in this view (approximately 1.4km from the viewpoint) during the winter of year 1 of operation. In front of this new feature, the route will also be visible on a shallow embankment with the overhead line equipment apparent. Evidence of vegetation losses associated with the construction phase will also be apparent. Given the noticeable changes which will arise as a result of the addition of new features in the direct frame of this channelled view, the magnitude of change is considered to be medium.

9.5.150 The medium magnitude of change assessed alongside the high sensitivity of the receptor will result in a moderate adverse effect in the winter of year 1 of operation.

9.5.151 In summer of year 1 of operation, intervening hedgerow vegetation will partially screen the new features in the view, although the effects will remain unchanged.

9.5.152 By year 15 and beyond to year 60 of operation reinstated and proposed planting will have matured and will better integrate the Proposed Scheme into the landscape. Both the route and the A41 Bicester Road realignment will be partially screened by proposed planting and will no longer be perceived as being as pronounced in the landscape. Given the distance of the viewpoint from the Proposed Scheme, the effects are not considered to be significant. These are reported in Volume 5: Appendix LV-001-011 Part 4.

Cumulative effects

9.5.153 There are no known future developments that are assumed to be under construction or operation at the same time as the Proposed Scheme which will result in a consequential cumulative effect on LCA or viewpoints. Cumulative developments which have been considered in the assessment are shown on Maps CT-13-021 to CT-13-025 (Volume 2, Cross Topic Appendix 1 Map Book).

Other mitigation measures

9.5.154 The permanent effects of the Proposed Scheme on landscape and visual receptors have been substantially reduced through incorporation of the measures described previously. Effects in year 1 of operation may be further reduced by establishing planting early in the construction programme, which will be considered during the detail design stage. This would provide additional screening and greater integration of the Proposed Scheme into the landscape. However, no other mitigation measures are considered practicable due to the high visibility of elements of the Proposed Scheme and the sensitivity of the surrounding receptors.

Summary of likely residual significant effects

9.5.155 In most cases, significant effects will reduce over time as the proposed mitigation planting matures and reaches its designed intention. However, the following residual

effects will remain following year 15 of operation:

- moderate adverse effects that will be at variance with the existing character of the Haddenham Vale LCA. These will arise due to the influence engineered landforms and different elements of the Proposed Scheme including road and PRoW crossings, trains, noise fence barriers and overhead line equipment will have on the landscape. These effects will reduce to not significant by year 60 of operation following greater maturity of the proposed planting;
- major adverse effects that will be at considerable variance with the existing character of the Hartwell House and Golf Course LCA and will degrade the integrity of this landscape. These will arise due to the influence engineered landforms and different elements of the Proposed Scheme including road and PRoW crossings, trains, noise fence barriers and overhead line equipment will have on the landscape. By year 60 of operation the effects will reduce to moderate adverse, despite greater maturity of the proposed planting, and will be at variance with the existing character and affect the setting of this historic landscape and are therefore considered significant;
- major and moderate adverse effects on views from residences and roads in the vicinity of Stoke Mandeville on Old Risborough Road, Risborough Road and Marsh Lane (111.2.001, 112.2.002 and 112.4.001) arising from visibility of different elements of the Proposed Scheme including earthworks, the new A4010 Stoke Mandeville bypass, the maintenance loop, PRoW crossings, trains, noise fence barriers and overhead line equipment and are therefore considered significant;
- moderate adverse effects which will result in a noticeable deterioration in the existing views from residences in the vale landscape between Aylesbury and Bishopstone (119.2.001). These will arise from visibility of different elements of the Proposed Scheme including earthworks, the A418 Oxford Road overbridge, the Footpath SMH/34 accommodation overbridge, trains, noise fence barriers and overhead line equipment. However the effects at viewpoint 119.2.001 will alter by year 60 of operation to minor beneficial due to the screening and integrating effect of planting and will not be significant;
- major adverse effects on views from users of PRoW in the grounds of Aylesbury Park Golf Club (122.3.001). These will arise from visibility of different elements of the Proposed Scheme including earthworks, the Footpath SBH/32 overbridge, train, noise fence barriers and overhead line equipment and are therefore considered significant;
- moderate adverse effects on views from residences and PRoW in the landscape to the north-west of Lower Hartwell (123.2.001 and 123.3.002). These will arise from visibility of different elements of the Proposed Scheme including earthworks, the Thame Valley viaduct, the Bridleway SBH/2 ovebridge and the Putlowes accommodation overbridge, trains, noise fence barriers and overhead line equipment. However the effects at viewpoint 123.2.001 will alter by year 60 of operation to minor adverse due to the greater maturing of proposed planting and will not be significant;

- moderate adverse effects on views from PRoW in the landscape to the west of Rabans Lane Industrial Park (124.3.001). These will arise from visibility of different elements of the Proposed Scheme including earthworks, the Bridleway SBH/2 overbridge, trains, noise fence barriers and overhead line equipment. However, at viewpoint 124.3.001 these effects will reduce by year 60 of operation due to the greater maturity of proposed planting and will not be significant; and
- moderate adverse effects on views from residences in the vicinity of Putlowes and Fleet Marston (126.2.001, 129.2.001 and 129.2.002). These will arise from visibility of different elements of the Proposed Scheme including earthworks, the Putlowes accommodation ovebridge and the Bridleway FMA/1 accommodation ovebridge, trains, noise fence barriers and overhead line equipment. However, the effects at viewpoints 129.2.001 and 129.2.002 will alter by year 60 of operation to minor adverse due to the greater maturing of proposed planting and will not be significant.

10 Socio-economics

10.1 Introduction

10.1.1 This section reports the likely significant economic and employment effects during the construction and operation of the Proposed Scheme.

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

- existing businesses and community organisations and thus the amount of local employment;
- local economies, including employment; and
- planned growth and development.

10.1.3 The beneficial and adverse socio-economic effects of the Proposed Scheme are reported at two different levels: route-wide; and CFA. Effects on levels of employment are reported at a route-wide level in Volume 3. Localised effects on businesses and observations on potential local economic effects are reported within each CFA report.

Construction

10.1.4 The proposed construction works will have relevance in terms of socio-economics in relation to:

- premises demolished, with their occupants and employees needing to relocate to allow for construction of the Proposed Scheme; and
- potential employment opportunities arising from construction in the local area (including in adjacent CFA).

Operation

10.1.5 The proposed operation of the route will have relevance in terms of socio-economics, in relation to the potential employment opportunities created by new business opportunities.

10.2 Scope, assumptions and limitations

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

10.2.2 There have been no variations to the socio-economic assessment methodology arising from engagement with stakeholders and community organisations.

10.3 Environmental baseline

Existing baseline

Study area description

10.3.2 Section 2 of this report provides a general overview of the Stoke Mandeville and Aylesbury area which includes data of specific relevance to socio-economics, notably demographic and employment data. The following provides a brief overview in terms of employment, economic structure, and labour market within the area[54].

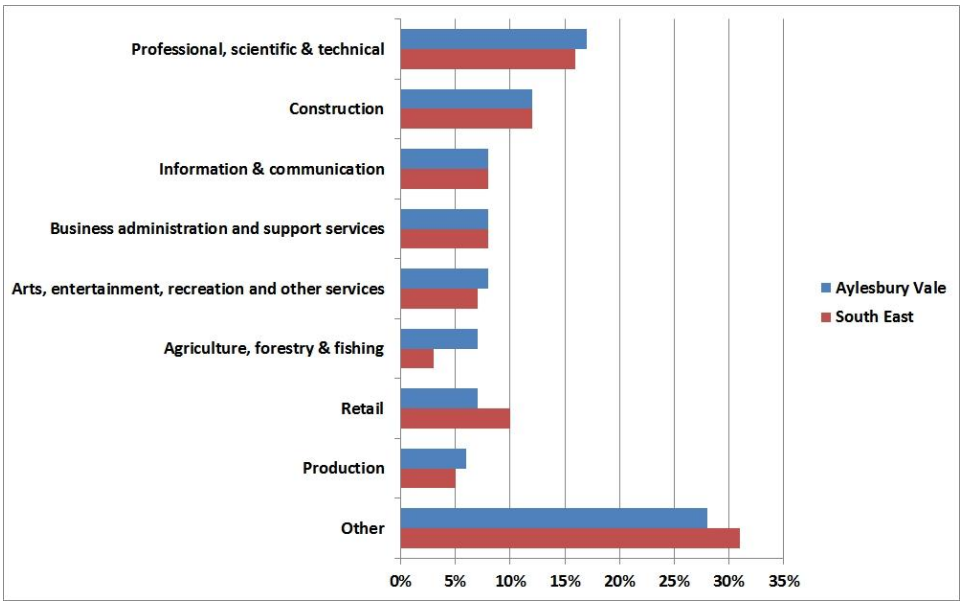
10.3.3 The area is almost entirely within the Aylesbury Vale district, with a small part of its land area in the neighbouring district of Wycombe. Where possible, baseline data has been gathered on demographic character areas (DCA)[55] to provide a profile of local communities. Volume 5: Appendix SE-02-012 shows the location of the DCA. The area contains five DCA; Marsh and Bishopstone, Hartwell and Stone, Stoke Mandeville, West Aylesbury and North West Aylesbury.

Business and labour market

10.3.4 Within Aylesbury Vale District the professional, scientific and technical services sector accounts for the largest proportion of businesses (17%), with the construction (12%), information and communication (8%) and business administration and support services (8%) sectors also accounting for large numbers of businesses within the district. This is shown in Figure 6[56]. For comparison within the South East region the professional, scientific and technical services sector also accounts for the largest number of businesses (16%), with construction (12%), retail (10%) and information and communication (8%) sectors also accounting for relatively large numbers of businesses within the region[57].

[54] Further information on the socio-economics baseline, with regard to business and labour market profile within the area, is contained in Volume 5: Appendix SE-001-000.
[55] DCA have been determined through an understanding of local context and aim to be aligned as closely as possible to groups of lower super output areas (LSOAs).
[56] The figure presents the proportion of businesses within each business sector in the borough, but not the proportion of employment by sector.
[57] ONS (2011), *UK Business: Activity, Size and Location 2011*, ONS, London. Please note 2011 data has been presented to provide an appropriate comparison with 2011 Census data.

Figure 6: Business sector composition in Aylesbury Vale District and the South East[58] [59]



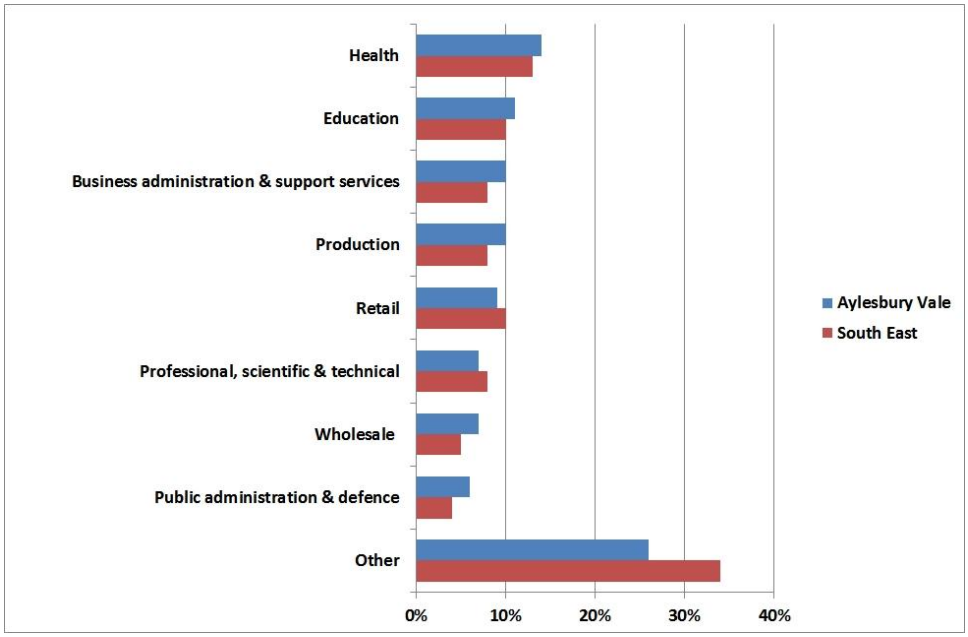
10.3.5 Approximately 66,000 people worked in Aylesbury Vale District while 200 people worked within Marsh and Bishopstone DCA, 600 within Hartwell and Stone DCA, 1,100 within Stoke Mandeville DCA, 3,200 within West Aylesbury DCA and 5,500 within North West Aylesbury DCA[60].

10.3.6 According to the ONS Business Register and Employment Survey 2011, the sector with the highest proportion of employment in Aylesbury Vale is health (14%) which accounts for a higher proportion of jobs than it does in both the South East and England (both 12%). Education makes up 10% of employment in the district, comparable to that recorded within the South East (10%) though slightly higher than that within England as a whole (9%). The business administration and support services sector accounts for 9% of employment in the district, compared to 8% recorded across both the South East and England as a whole. This is shown in Figure 7.

10.3.7 Key sectors, in terms of employment, for Marsh and Bishopstone DCA are accommodation and food services (34%), production (11%) and professional, scientific and technical (10%). In Hartwell and Stone DCA these are health (45%) and accommodation and food services (20%). Key sectors in Stoke Mandeville are production (16%), business administration and support services (16%), information and communication (13%) and education (13%). In West Aylesbury DCA, key sectors are health (54%) and wholesale (12%). Key sectors for North West Aylesbury DCA are wholesale (21%), retail (16%) and production (13%).

[58] 'Other' includes motor trades, wholesale, transport and storage (including postal), accommodation and food services, finance and insurance, property, public administration and defence, education and health sectors.
[59] ONS (2012), *UK Business: Activity, Size and Location 2011*, ONS, London.
[60] ONS (2012), *Business Register and Employment Survey 2011*, ONS, London.

Figure 7: Proportion of employment by industry in the Aylesbury Vale District and the South East[61] [62]



10.3.8 According to the 2011 Census[63], the employment rate[64] within the Aylesbury Vale district in 2011 was 72% (which represents 91,000 people), which was higher than 68% recorded for the South East and 65% for England as a whole. The large difference between resident workforce and employment within the district indicates a high level of commuting out of the area. The employment rate in the Marsh and Bishopstone DCA was 75%, 73% in Hartwell and Stone DCA, 72% in Stoke Mandeville DCA, 78% in West Aylesbury DCA and 69% in North West Aylesbury DCA.

10.3.9 The unemployment rate for Aylesbury Vale in 2011 stood at 5%, which was lower than the England average of 7%. The unemployment rate in the Marsh and Bishopstone DCA was 3%, 5% in Hartwell and Stone DCA, 4% in Stoke Mandeville DCA, 5% in West Aylesbury DCA and 8% in North West Aylesbury DCA[65].

10.3.10 According to the 2011 Census, 32% of Aylesbury Vale district residents aged 16 and over were qualified to National Vocational Qualification Level 4 (NVQ4), compared to 30% in the South East and 27% in England, while 17% of Aylesbury Vale residents have no qualifications compared to 19% in the South East and 23% in England. In 2011 40% of Marsh and Bishopstone DCA residents aged 16 and over were qualified to NVQ4 level, compared to 39% in Hartwell and Stone DCA, 37% in Stoke Mandeville DCA, 27% in West Aylesbury and 17% in North West Aylesbury DCA.

[61] Other' includes agriculture, forestry and fishing, construction, motor trades, transport and storage (including postal), accommodation and food services, information and communication, finance and insurance, property and arts, entertainment and other services sectors.
[62] ONS (2012), *Business Register and Employment Survey 2011*, ONS, London.
[63] ONS (2012), *Census 2011*, ONS, London
[64] The proportion of working age (16-74 years) residents which is in employment. Employment comprises the proportion of the total resident population who are 'in employment' and includes full-time students who are employed.
[65] Unemployment figures have been rounded to the nearest whole number. DCA unemployment rates are presented for each DCA in this chapter while in Section 2 they are shown in aggregate.

10.3.11 The proportion of residents with no qualifications was 15% in both Marsh and Bishopstone DCA and Hartwell and Stone DCA, 17% in Stoke Mandeville DCA, 16% in West Aylesbury DCA and 25% in North West Aylesbury DCA.

10.3.12 Marsh and Bishopstone DCA, Hartwell and Stone DCA, Stoke Mandeville DCA and West Aylesbury DCA are each residential areas, set within a predominantly rural and agricultural area, recording high rates of employment, low unemployment and high qualifications attainment. North West Aylesbury DCA is relatively less prosperous compared with the other DCA in the area, experiencing relatively high levels of unemployment and lower skills levels.

Future baseline

Construction (2017)

10.3.13 Volume 5: Appendix CT-004-000/1 provides details of the developments which are assumed to have been implemented by 2017. There are no consents in this area which are expected to accommodate significant additional employment by 2017.

Operation (2026)

10.3.14 Volume 5: Appendix CT-004-000/2 provides details of the developments which are assumed to have been implemented by 2026. Implementation of all outstanding development consents and land allocations will result in additional jobs being accommodated by 2026, specifically at the Berryfields Major Development Area (MDA)66.

10.4 Effects arising during construction

Avoidance and mitigation measures

10.4.1 In order to avoid or minimise the environmental impacts during construction, the design of the Proposed Scheme includes provisions to maintain access to businesses during the construction phase. The draft CoCP includes a range of provisions that will help mitigate the socio-economic effects associated with construction within this area, including:

- consulting businesses located close to hoardings on the design, materials used and construction of the hoarding to reduce impacts on access to and visibility of their premises (draft CoCP, Section 5);
- reducing nuisance through sensitive layout of construction sites (draft CoCP, Section 5);
- applying best practicable means (BPM) during construction works to reduce noise (including vibration) at sensitive receptors including local businesses(draft CoCP, Section 13);
- requiring contractors to monitor and manage flood risk and other extreme

[66] It has not been possible to calculate net additional employment for this development owing to insufficient information about existing employment on site.

weather events which may affect socio-economic resources during construction (draft CoCP, Sections 5 and 16); and

- site specific traffic management measures including requirements relating to the movement of traffic from business and commercial operators of road vehicles, including goods vehicles (draft CoCP, Section 14).

Assessment of impacts and effects

Temporary effects

Change in business amenity value

10.4.2 No non-agricultural businesses[67] have been identified within the area which are expected to experience significant amenity effects as a result of the Proposed Scheme.

Isolation

10.4.3 No non-agricultural businesses have been identified within the area that are expected to experience significant isolation effects as a result of the Proposed Scheme.

Construction employment

10.4.4 There are plans to locate construction compounds for the Proposed Scheme within the Stoke Mandeville and Aylesbury area, including at A41 Bicester Road Embankment main compound. These locations are set out in Section 2.3 of this report.

10.4.5 The use of these sites could result in the creation of up to 1,260 person years of construction employment[68] opportunities or approximately 126 full-time equivalent jobs[69], that, depending on skill levels required and the skills of local people, are potentially accessible to residents in the locality and to others living further afield. The impact of the direct construction employment creation has been assessed as part of the route-wide assessment (Volume 3).

10.4.6 Direct construction employment created by the Proposed Scheme could also lead to opportunities for local businesses to supply the project or to benefit from expenditure of construction workers. The impact of the indirect construction employment creation has been assessed as part of the route-wide assessment (Volume 3).

Cumulative effects

10.4.7 No committed (inter-project) developments have been identified that are considered to significantly interact with the Proposed Scheme.

10.4.8 Cumulative effects arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are assessed and reported as part of the route-wide assessment (Volume 3).

[67] Possible employment loss in agricultural businesses as a result of the Proposed Scheme is being estimated at the route-wide level.
[68] Construction labour is reported in construction person years, where one construction person year represents the work done by one person in a year composed of a standard number of working days.
[69] Based on the convention that 10 employment years is equivalent to one full time equivalent job.

Permanent effects

Businesses

10.4.9 Businesses directly affected, i.e. those that lie within land required for the construction of the Proposed Scheme, are reported in groups where possible to form defined resources, based on their location and operational characteristics. A group could contain either one or a number of businesses reflecting the fact that a building may have more than one occupier or that similar businesses/resources are clustered together.

10.4.10 One business accommodation unit within the Stoke Mandeville and Aylesbury area, the Whitethorn Fields Medical Clinic, will be directly impacted upon by the Proposed Scheme. However, from an employment perspective, no significant direct effects on non-agricultural employment have been identified within the Stoke Mandeville and Aylesbury area.

10.4.11 It is estimated that land required for the construction of the Proposed Scheme will result in the displacement or possible loss of approximately 10 jobs[70] in the Stoke Mandeville and Aylesbury area. Taking into account total employment within the area, the displacement or possible loss of jobs is considered to be modest compared to the scale of economic activity and opportunity in the area.

Cumulative effects

10.4.12 No committed (inter-project) developments have been identified that are considered to significantly interact with the Proposed Scheme.

10.4.13 Cumulative effects arise in relation to the accumulation of individual resource based job displacement/losses on a local labour market. These effects are assessed and reported as part of the route-wide assessment (see Volume 3).

Other mitigation measures

10.4.14 The assessment has concluded that there are no significant adverse effects arising during construction in relation to businesses directly affected by the Proposed Scheme. Businesses displaced by the Proposed Scheme will be fully compensated within the provisions of the Compensation Code. HS2 Ltd recognises the importance of displaced businesses being able to relocate to new premises and will therefore provide additional support over and above statutory requirements to facilitate this process.

10.4.15 The construction of the Proposed Scheme offers considerable opportunities to businesses and residents along the line of route in terms of supplying goods and services and obtaining employment. HS2 Ltd is committed to working with its suppliers to build a skilled workforce that fuels further economic growth across the UK.

[70] Employment within businesses has been estimated through a combination of sources, for example, surveys of businesses, the Experian employment dataset, employment floor space and the Homes and Communities Agency (HCA) *Employment Densities Guide 2nd Edition* (2010). The estimate is calculated using standard employment density ratios and estimates of floor areas and may vary from actual employment at the sites.

Summary of likely residual significant effects

10.4.16 No residual significant socio-economic effects are likely to arise during construction of the Proposed Scheme.

10.5 Effects arising during operation

Avoidance and mitigation measures

10.5.1 No mitigation measures are proposed during operation within this area.

Assessment of impacts and effects

Resources with direct effects

10.5.2 There are no resources considered likely to experience significant direct effects during the operational phase of the Proposed Scheme within this area.

Change in business amenity

10.5.3 No non-agricultural businesses have been identified within the area that are expected to experience significant amenity effects as a result of the Proposed Scheme.

Operational employment

10.5.4 Operational employment will be created at locations along the route including stations, train crew facilities and infrastructure/maintenance depots which are considered unlikely to be accessed by residents of the area.

10.5.5 Direct operational employment created by the Proposed Scheme could also lead to indirect employment opportunities for local businesses in terms of supplying the project or benefiting from expenditure of directly employed workers on goods and services. Some of these employment opportunities will be accessible to residents in the locality.

10.5.6 The impact of operational employment creation has been assessed as part of the route-wide assessment (see Volume 3).

Cumulative effects

10.5.7 No cumulative developments have been identified that are considered to significantly interact with the Proposed Scheme.

Other mitigation measures

10.5.8 The assessment has concluded that operational effects within this section of the route will be either negligible or beneficial and therefore other mitigation is not required.

Summary of likely residual significant effects

10.5.9 No residual significant socio-economic effects are likely to arise during operation of the Proposed Scheme.

11 Sound, noise and vibration

11.1 Introduction

11.1.1 This section reports the assessment of the likely noise and vibration significant effects arising from the construction and operation of the Proposed Scheme for the Stoke Mandeville and Aylesbury area on:

- people, primarily where they live ('residential receptors') in terms of a) individual dwellings and b) on a wider community basis, including any shared community open areas[71]; and
- community facilities such as schools, hospitals, places of worship, and also commercial properties such as offices and hotels, collectively described as 'non-residential receptors' and 'quiet areas'[72].

11.1.2 The assessment of likely significant effects from noise and vibration on agricultural, community, ecological or heritage receptors and the assessment of tranquillity are presented in Sections 3, 5, 6, 7 and 9 of this report respectively.

11.1.3 In this assessment 'sound' is used to describe the acoustic conditions which people experience as a part of their everyday lives. The assessment considers how those conditions may change through time and how sound levels and the acoustic character of community areas is likely to be modified through the introduction of the Proposed Scheme. Noise is taken as unwanted sound and hence adverse effects are noise effects and mitigation is, for example, by noise barriers.

11.1.4 Effects can either be temporary from construction or permanent from the operation of the Proposed Scheme. These effects may be direct, resulting from the construction or operation of the Proposed Scheme, and/or indirect e.g. resulting from changes in traffic patterns on existing roads or railways that result from the construction or operation of the Proposed Scheme.

11.1.5 This section sets out the means to avoid or reduce the adverse effects that may occur. The approaches to assessing sound, noise and vibration and appropriate mitigation are outlined in Volume 1 and scope and methodology are defined in the following documents:

- Scope and Methodology Report (SMR) (Appendix CT-001-000/1); and
- SMR Addendum (Appendix CT-001-000/2).

11.1.6 More detailed information and mapping regarding the sound, noise and vibration assessment for Stoke Mandeville and Aylesbury is available in the relevant appendices in Volume 5:

[71] 'shared community open areas' are those that the emerging National Planning Practice Guidance identifies may partially offset a noise effect experienced by residents at their dwellings and are either a) relatively quiet nearby external amenity spaces for sole use by a limited group of residents as part of the amenity of their dwellings or b) a relatively quiet external publicly accessible amenity space (e.g. park to local green space) that is nearby.

[72] Quiet areas are defined in the Scope and Methodology Report as either Quiet Areas as identified under the Environmental Noise Regulations or are resources which are prized for providing tranquillity (further information is provided in Section 9).

- sound, noise and vibration, route-wide assumptions and methodology (Appendix SV-001-000);
- sound, noise and vibration baseline (Appendix SV-002-011);
- sound, noise and vibration construction assessment (Appendix SV-003-011);
- sound, noise and vibration operation assessment (Appendix SV-004-011); and
- Map Series SV-01, SV-02, SV-03 and SV-04 (Volume 5, Sound, noise and vibration Map book).

11.2 Environmental baseline

Existing baseline

11.2.1 The existing baseline sound environment for this area is varied, reflecting the mixture of small towns, villages, hamlets and isolated properties in a largely rural setting.

11.2.2 The largest settlement in this area is Aylesbury. Transport infrastructure through Aylesbury includes road links and the Marylebone to Aylesbury line and the less regularly used Princes Risborough to Aylesbury Line. The main roads connecting Aylesbury to neighbouring towns include the A413, the A418 Oxford Road and the A41 Bicester Road. Traffic on these main roads forms the dominant sound source for much of Aylesbury.

11.2.3 In some of the outskirts of Aylesbury, whilst road traffic on the main roads remains the dominant noise source, this is perceived as being 'distant' and at relatively low level, and natural and agricultural sounds are more prevalent. In these areas daytime sound levels are typically 45 to 50dB[73] with night-time sound levels varying between approximately 35 and 45dB[74].

11.2.4 In Stoke Mandeville the main source of sound is traffic on Risborough Road and other local roads. Other sound sources include the more distant A413 and the Marylebone to Aylesbury rail line. Daytime sound levels in locations close to Risborough Road are typically around 65dB with increased sound levels at locations very close to the road. In locations in the village further, or shielded, from the busier roads, typical daytime sound levels are 50dB with night-time sound levels typically reducing to around 45dB.

11.2.5 In the less populated parts of this area away from Aylesbury, the soundscape generally includes the sound of distant traffic and, in some locations, agricultural activities and natural sounds are also audible. In these locations daytime sound levels are typically 43db to 50dB with night-time levels around 5db to 10dB lower.

11.2.6 Further information on the existing baseline, including baseline sound levels and baseline monitoring results, is provided for this area in Volume 5: Appendix SV-002-011.

[73] Quoted dB values at residential areas refer to the free-field 16 hour daytime (07:00 to 23:00) equivalent continuous sound pressure level, $L_{pAeq,16hr}$.
[74] Night-time sound levels refer to the free-field 8 hour night-time (23:00 to 07:00) equivalent continuous sound pressure level, $L_{pAeq,8hr}$.

11.2.7 It is likely that the majority of receptors adjacent to the line of route are not currently subject to appreciable vibration[75]. Vibration at all receptors from the Proposed Scheme has therefore been assessed using specific thresholds, below which receptors will not be affected by vibration. Further information is provided in Volume 1, Section 8.

Future baseline

11.2.8 Without the Proposed Scheme, existing sound levels in this area are likely to increase slowly over time. This is primarily due to road traffic growth. Changes in car technology may offset some of the expected sound level increases due to traffic growth on low speed roads. On higher speed roads[76], tyre sound dominates and hence the expected growth in traffic is likely to continue to increase ambient sound levels.

Construction (2017)

11.2.9 The assessment of noise from construction activities assumes a baseline year of 2017 which represents the period immediately prior to the start of the construction period. As a reasonable worst case, it has been assumed that no change in baseline sound levels will occur between the existing baseline (2012/13) and the future baseline year of 2017. The assessment of noise from construction traffic assumes a baseline year of 2021, representative of the middle of the construction period when the construction traffic flows are expected to be at their peak. Further information can be found in Section 12.

Operation (2026)

11.2.10 The assessment is based upon the predicted change in sound levels that result from the Proposed Scheme. The assessment initially considered a worst case (that would overestimate the change in levels) by assuming that sound levels would not change from the existing baseline year of 2012/2013. Where significant effects were identified on this basis, the effects have been assessed using a baseline year of 2026 to coincide with the proposed start of passenger services. The future baseline is for the sound environment that would exist in 2026 without the Proposed Scheme.

11.3 Effects arising during construction

Local assumptions and limitations

Local assumptions

11.3.1 The construction arrangements that form the basis of the assessment are presented in Section 2.3.

[75] Further information is available in the Volume 5: Appendix SV-001-000, the SMR and its Addendum.
[76] Tyre noise typically becomes the dominant sound source for steady road traffic at speeds above approximately 30mph.

Local limitations

11.3.2 In this area, there are a number of locations where the land or property owners did not permit baseline sound level monitoring to be undertaken at their premises. However, sufficient information has been obtained to undertake the assessment. Further information is provided in Volume 5: Appendix SV-003-011.

Avoidance and mitigation measures

11.3.3 The assessment 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;
- where, despite the implementation of BPM, the noise exposure exceeds the criteria defined in the draft CoCP, noise insulation or ultimately temporary re-housing will be offered in accordance with the draft CoCP noise insulation and temporary re-housing policy;
- lead contractors will seek to obtain prior consent from the relevant local authority under Section 61 of CoPA for the proposed construction works. The consent application will set out BPM measures to minimise construction noise, including control of working hours, and provide a further assessment of construction noise and vibration including confirmation of noise insulation/temporary re-housing provision;
- contractors will undertake and report such monitoring as is necessary to assure and demonstrate compliance with all noise and vibration commitments. Monitoring data will be provided regularly to and be reviewed by the Nominated Undertaker and will be made available to the local authorities; and
- contractors will be required to comply with the terms of the draft CoCP and appropriate action will be taken by the Nominated Undertaker as required to ensure compliance.

11.3.4 In addition to this mitigation, screening as described in the draft CoCP[77] has been assumed along the edge of the construction site boundary adjacent to Old Risborough Road, Moat Farm, properties on the A418 Oxford Road adjacent to the works (Park Villa, Hartwell Cottage and the Oaks), Hartwell House, and the Putlowes. Temporary screening has also been assumed along the edge of the works associated with realigning the Princes Risborough to Aylesbury Line adjacent residential property on the south-western edge of Aylesbury (in the vicinity of Westfield and Batt Furlong) and Booker Park School.

11.4 Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.4.1 The mitigation measures will reduce noise inside all dwellings such that it does not reach a level where it would significantly affect[78] residents.

Residential receptors: direct effects – communities

11.4.2 The avoidance and mitigation measures in this area will avoid airborne construction noise adverse effects[78] on the majority of receptors and communities.

11.4.3 With regard to noise outside dwellings, the assessment of temporary effects takes account of construction noise relative to existing sound levels.

11.4.4 In locations with lower existing sound levels[79], construction noise effects[78] are likely to be caused by changes to noise levels outside dwellings. These may be considered by the local community as an effect on the acoustic character of the area and hence be perceived as a change in the quality of life. These effects are considered to be significant when assessed on a community basis taking account of the local context[80].

11.4.5 In this area, the mitigation measures previously described, will reduce the effects of outdoor construction noise on the acoustic character around the local residential communities such that the adverse effects identified are considered to not be significant.

Residential receptors: indirect effects

11.4.6 Significant noise effects on residential receptors arising from construction traffic are unlikely to occur in this area.

Non-residential receptors: direct effects

11.4.7 Significant construction noise or vibration effects on non-residential receptors are unlikely to occur in this area.

[77] As described in the draft CoCP, provided as necessary by solid temporary hoarding, temporary earth stockpiles, screening close to the activities or other means to provide equivalent noise reduction.
[78] Information is provided in the emerging National Planning Practice Guidance – Noise http://planningguidance.planningportal.gov.uk.
[79] Further information is provided in Volume 5: Appendix SV-001-000.
[80] Further information is provided in Volume 5: Appendix SV-001-000 and SV-003-011.

Non-residential receptors: indirect effects

11.4.8 Significant noise effects on non-residential receptors arising from construction traffic are unlikely to occur in this area.

11.4.9 Cumulative effects from the Proposed Scheme and other committed development.

11.4.10 This assessment has considered the potential cumulative construction noise effects of the Proposed Scheme and other committed developments[81]. In this area, construction noise or vibration from the Proposed Scheme is unlikely to result in any significant cumulative noise effects.

Summary of likely residual significant effects

11.4.11 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[78] residents.

11.4.12 The measures also reduce the adverse effects[78] of outdoor construction noise on the acoustic character around the local residential communities such that the effects are not considered to be significant.

11.5 Effects arising during operation

Local assumptions and limitations

Local assumptions - service pattern

11.5.1 The effects of noise and vibration from the operation of the Proposed Scheme have been assessed based on the highest likely train flows, including the Phase Two services. Trains are expected to be 400m long during peak hours and a mix of 200m and 400m long trains at other times.

11.5.2 The expected passenger service frequency for both Phase One, and Phase One with Phase Two services, are described in Volume 1[82]. As a reasonable worst case, this assessment is based upon the service pattern for Monday to Saturday including Phase Two services. Passenger services will start at or after 05:00 from the terminal stations and in this area will progressively increase to the number of trains per hour in each direction on the main lines set out in Table 14. This number of services is assumed to operate every hour from 07:00 to 21:00. The number of services will progressively decrease after 21:00 and the last service will arrive at terminal stations by 24:00. Train speeds are shown in Table 14.

[81] Refer to Volume 5: Appendix CT-004-000.
[82] The change in noise and vibration effects between the different passenger services is assessed in Volume 1.

Table 14: Train flows and speeds

Description of line	Time period for peak daytime flows	Number of trains per hour in each direction with Phase Two services (Phase One only trains per hour in each direction is set out in brackets)	Speed
Main line between London and the north	0700 - 2100 hours	18 (14)	330 kph for timetabled trains (assumed 90% of services), and 360 kph for 10% of services

Avoidance and mitigation measures

11.5.3 The development of the Proposed Scheme has, as far as reasonably practicable, kept the alignment away from main communities and low in the ground. These avoidance measures have protected many communities from likely significant noise or vibration effects.

Airborne noise

11.5.4 HS2 trains will be quieter than the relevant current European Union specifications. This will include reduction of aerodynamic noise from the pantograph that otherwise would occur above 300kph (186mph) with current pantograph designs, drawing on proven technology in use in East Asia. The track will be specified to reduce noise, as will the maintenance regime. Overall these measures would reduce noise emissions by approximately 3dB at 360kph compared to a current European high speed train operating on the new track. Further information is provided in Volume 5: Appendix SV-001-000.

11.5.5 To avoid or reduce significant airborne noise effects, the Proposed Scheme incorporates noise barriers in the form of landscape earthworks, noise fence barriers and/or 'low-level' barriers on viaducts. Noise barrier locations are shown on Map Series SV-05 (Volume 2, CFA11 Map Book).

11.5.6 Generally, the assessment has been based on noise barriers having a noise reduction performance equivalent to a noise fence barrier with a top level 3m above the top of the rail, which is acoustically absorbent on the railway side, and which is located 5m to the side of the outer rail. In practice, barriers may differ from this description, but will provide the same acoustic performance. For example, where noise barriers are in the form of landscape earthworks they will need to be higher above rail level to achieve similar noise attenuation to a 3m barrier because the crest of the earthwork will be further than 5m from the outer rail.

11.5.7 The Proposed Scheme incorporates 'low-level' barriers into the design of viaducts. Where needed to avoid or reduce significant airborne noise effects, these barriers are designed to provide noise reduction that is equivalent to a 2m high absorptive noise barrier located on the parapet of the viaduct. Locating these 'low-level' barriers close to the rail also reduces visual impact and limits the mass of the viaduct itself.

11.5.8 Noise effects are reduced in other locations along the line by landscape earthworks provided to avoid or reduce significant visual effects and engineering structures such as cuttings and safety fences on viaducts (where noise barriers are not required). The location of these barriers is shown on Map Series SV-05 (Volume 2, CFA11 Map Book).

11.5.9 The Proposed Scheme includes taller barriers to the south-west and to the north-west of Aylesbury; to the south of Stoke Mandeville; and between the Proposed Scheme and Lower Hartwell and Hartwell House that avoid or further reduce significant noise effects in these areas.

11.5.10 Significant noise effects from the operational static sources such as line-side equipment will be avoided through their design and the specification of noise emission requirements (see Volume 5: Appendix SV-001-000).

11.5.11 Noise insulation measures will be offered for qualifying buildings as defined in the Noise Insulation (Railways and Other Guided Transport Systems) Regulations 1996[83] (the Regulations). The assessment reported in this section provides an estimate of the buildings that are likely to qualify under the Regulations. Qualification for noise insulation under the Regulations will be identified and noise insulation offered at the time that the Proposed Scheme becomes operational.

11.5.12 Where required, as well as improvements to the noise insulation of windows facing the railway, ventilation will be provided so that windows can remain closed to protect internal sound levels.

11.5.13 Following Government's emerging National Planning Practice Guidance[84], where the noise from the use of the Proposed Scheme measured outside a dwelling exceeds the Interim Target defined by the WHO Night Noise Guidelines for Europe[85], residents are considered to be significantly affected by the resulting noise inside their dwelling. The effect on people at night due to the maximum sound level as each train passes has also been assessed[86]. The Interim Target is a lower level of noise exposure than the Regulations trigger threshold for night noise. In these particular circumstances, where night-time noise levels for the use of new or additional railways authorised by the Bill are predicted following the methodology set out in the Regulations to exceed 55 dB[87], or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion[86], noise insulation will be offered for these additional buildings.

Ground-borne noise and vibration

11.5.14 Significant ground-borne noise or vibration effects will be avoided or reduced through the design of the track and track-bed.

[83] Her Majesty's Stationery Office (1996), The Noise Insulation (Railways and Other Guided Transport Systems) Regulations, London.
[84] National Planning Practice Guidance – Noise http://planningguidance.planningportal.gov.uk.
[85] World Health Organization, Night-time Noise Guidelines for Europe, 2010.
[86] During the night (2300-0700) a significant effect is also identified where the Proposed Scheme results in a maximum sound level at the façade of a building at or above: 85dB L_{pAFmax} (where the number of train pass-bys exceeding this value is less than or equal to 20); or 80dB L_{pAFmax} (where the number of train pass-bys exceeding this value is greater than 20).
[87] Equivalent continuous level, L_{pAeq}, 23:00-07:00 measured without reflection from the front of buildings.

Assessment of impacts and effects

Residential receptors: direct effects – individual dwellings

11.5.15 Taking account of the avoidance and mitigation measures incorporated into the Proposed Scheme, the assessment has identified one residential building, closest to the Proposed Scheme at Mill House Farm, Risborough Road where noise would exceed the daytime trigger threshold set in the Regulations. It is therefore estimated that this building is likely to qualify for noise insulation under the Regulations. This building is indicated on Map Series SV-05 (Volume 5, Sound, noise and vibration Map Book).

11.5.16 The assessment has identified four additional residential buildings close to the Proposed Scheme where the daytime forecast noise level does not exceed the threshold set in the Regulations but the forecast night-time noise level would exceed the World Health Organisation's Interim Target of 55dB87, or the maximum noise level (dependent on the number of train passes) as a train passes exceeds the criterion87. It is estimated that these buildings will also be offered noise insulation as described previously in the Avoidance and mitigation measures section. These buildings are shown on Map series SV-05 (Volume 5, Sound, Noise and Vibration Map Book):

- Putlowes Drive, Fleet Marston;
- Whitethorn Farm and 5 Whitethorn Close, Risborough Road, Stoke Mandeville; and
- Old Moat Farmhouse, Marsh Lane, Stoke Mandeville.

11.5.17 The mitigation measures including noise insulation will reduce noise inside all dwellings such that it will not reach a level where it would significantly affect residents.

Residential receptors: direct effects – communities

11.5.18 The avoidance and mitigation measures in this area will avoid airborne noise adverse effects on the majority of receptors, and at the following communities:

- Stoke Mandeville (except as noted in Table 15);
- Aylesbury (except as noted in Table 15);
- Bishopstone;
- Stone;
- Sedrup (except as noted in Table 15); and
- Lower Hartwell.

11.5.19 Taking account of the envisaged mitigation, Map Series SV-05 (Volume 2, CFA11 Map Book) shows the long term 40dB[88] night-time sound level contour from the operation of trains on the Proposed Scheme. The extent of the 40dB night-time sound level contour is equivalent to, or slightly larger than, the 50dB daytime contour[89]. In general, below these levels adverse effects are not expected.

11.5.20 Above 40dB during the night and 50dB during the day the effect of noise is dependent on the baseline sound levels in that area and the change in sound level (magnitude of effect) brought about by the Proposed Scheme. The airborne noise impacts and effects forecast for the operation of the scheme are presented on Map Series SV-05 (Volume 2 Map Book).

11.5.21 The changes in noise levels are likely to affect the acoustic character of the area such that there is a perceived change in the quality of life and are considered to be significant when assessed on a community basis[90] taking account of the local context[91].

11.5.22 In this area, the direct adverse effects[78] on the areas of the residential communities identified in Table 15 are considered to be significant.

Table 15: Direct adverse effects on residential communities and shared open areas that are considered significant on a community basis

Significant effect number (see Map series SV-05)	Source of significant effect	Time of day	Location and details
OSV11-C01	Airborne noise increase from new train services and the road traffic on Stoke Mandeville Bypass.	Daytime and night-time	Southern edge of Stoke Mandeville. Approximately 30 dwellings along the Risborough Road in the vicinity of Old Risborough Road and Whitethorn Close including shared open areas. Forecast increases in sound from the railway are likely to cause a major adverse effect on the acoustic character of the area around the closest properties, reducing with distance away from the Proposed Scheme. The effect on the acoustic character of residential areas that are located further from the railway would be a minor effect.
OSV11-C02	Airborne noise increase from new train services	Daytime and night-time	Western edge of Stoke Mandeville. Approximately 70 dwellings in the vicinity of Marsh lane, Lower Road, Yew Tree Close, Chestnut Way and Chapel Lane including shared open areas. Forecast increases in sound from the railway are likely to cause minor adverse effects on the acoustic character of the area around the closest properties, with moderate effects at properties on Chestnut Way.
OSV11-C03	Airborne noise increase from new train services, road traffic on Stoke Mandeville Bypass and train services on the realigned Princes Risborough to Aylesbury	Daytime and night-time	South western edge of Aylesbury. Approximately 25 dwellings in the vicinity of Westfield and Batt Furlong including the shared open area by Westfield. Forecast increases in sound from the new railway, new road by-pass and the realigned railway are likely to cause a minor adverse effect on the acoustic character of the area around the closest

[88] Defined as the equivalent continuous sound level from 23:00 to 07:00 or $L_{pAeq,night}$

[89] With the train flows described in the assumptions section of this CFA Report, the daytime sound level (defined as the equivalent continuous sound level from 07:00 to 23:00 or $L_{pAeq,day}$ from the Proposed Scheme would be approximately 10dB higher than the night-time sound level. The 40dB contour therefore indicates the distance from the Proposed Scheme at which the daytime sound level would be 50dB.

[90] Further information is contained in Volume 1.

Significant effect number (see Map series SV-05)	Source of significant effect	Time of day	Location and details
	line		properties.
OSV11-C04	Airborne noise increase from new train services	Daytime and night-time	South western edge of Aylesbury. Approximately 130 dwellings in the vicinity of Isis Close, Deverill Road, Oat Close and the corner of Anton Way including shared open areas behind Isis and Oat Close. Forecast increases in sound from the railway are likely to cause a moderate adverse effect on the acoustic character of the area around the closest properties, reducing with distance away from the Proposed Scheme. The effect on the acoustic character of residential areas on the corner of Anton Way that are located further from the railway would be a minor effect.
OSV11-C05	Airborne noise increase from new train services	Daytime and night-time	Sedrup. Approximately 10 dwellings in the vicinity of Sedrup Lane. Forecast increases in sound from the railway are likely to cause a moderate adverse effect on the acoustic character of the area around the closest properties, reducing with distance away from the Proposed Scheme.

Residential receptors: indirect effects

11.5.23 Changes in road traffic due to the Proposed Scheme are likely to cause beneficial noise effects on residential receptors along the A4010 Risborough Road, benefiting dwellings facing the road from just south of the junction with Chapel Lane to the junction with Lower Road.

11.5.24 The changes in noise levels in this local area resulting from the reduction in road traffic are likely to benefit the acoustic character of the area such that there is a perceived improvement in the quality of life. These effects are considered significant when assessed on a community basis taking account of the local context[92].

Non-residential receptors: direct effects

11.5.25 The assessment of operational noise and vibration indicates that significant effects are likely on the non-residential receptor identified in Table 16.

11.5.26 The assessment of effects on non-residential receptors has been undertaken on a reasonable worst case basis. Further information can be found in Volume 5: Appendix SV-004-011.

[92] Further information is provided in Volume 5: Appendix SV-001-000 and SV-004-011.

Table 16: Likely significant noise or vibration effects on non-residential receptors arising from operation of the Proposed Scheme

Significant effect number (see Map series SV-05)	Type of significant effect and source	Time of day	Location and details
OSV11-N01	Minor adverse effect on school activities[93] due to increased sound levels from the operation of the new railway, the realigned Princes Risborough to Aylesbury Line and traffic on the Stoke Mandeville by-pass.	Daytime	Booker Park School, Stoke Leys Close

Non-residential receptors: indirect effects

11.5.27 The assessment of operational noise and vibration indicates that significant effects are likely on the non-residential receptor identified in Table 16.

11.5.28 The assessment of effects on non-residential receptors has been undertaken on a reasonable worst case basis. Further information can be found in Volume 5: Appendix SV-004-011.

Table 17: Likely significant noise or vibration effects on non-residential receptors arising from operation of the Proposed Scheme

Significant effect number (see Map series SV-05)	Type of significant effect and source	Time of day	Location and details
OSV11-N02	Likely minor beneficial effect on the acoustic character of the area around the church due to a permanent reduction in road traffic caused by the Proposed Scheme.	Daytime	Church of St Mary the Virgin, at the at the junction of Lower Road and Risborough Road

Summary of likely significant residual effects

11.5.29 The mitigation measures reduce noise inside all dwellings such that it does not reach a level where it would significantly affect[78] residents.

11.5.30 The avoidance and mitigation measures in this area will avoid noise and vibration adverse effects[78] on the majority of receptors and communities including shared open areas.

11.5.31 Taking account of the avoidance and mitigation measures and the local context, the residual permanent noise adverse effects[78] on the acoustic character of the communities closest to the Proposed Scheme at the southern edge of Stoke Mandeville; the western edge of Stoke Mandeville; the south-western edge of Aylesbury; and Sedrup are considered significant.

[93] Potential risk of disturbance of teaching activities outdoors, and indoors when windows are wide open.

11.5.32 Beneficial noise effects have been identified on the acoustic character around dwellings facing the Risborough Road in Stoke Mandeville due to a reduction in road traffic caused by the Proposed Scheme. The church of St Mary the Virgin at Stoke Mandeville would also benefit from this reduction.

11.5.33 On a worst case basis, a significant noise effect has been identified on Booker Park School. There is a minor risk that noise from the Proposed Scheme i disturbs outdoor teaching activities, or teaching activities inside when the windows are open.

11.5.34 HS2 Ltd will continue to seek reasonably practicable measures to further reduce or avoid these significant effects. In doing so HS2 Ltd will continue to engage with stakeholders to fully understand the receptor, its use and the benefit of the measures. The outcome of these activities will be reflected in the Environmental Minimum Requirements.

12 Traffic and transport

12.1 Introduction

12.1.1 This traffic and transport section describes the likely impacts on all forms of transport and the consequential effects arising from the construction and operation of the Proposed Scheme through the Stoke Mandeville and Aylesbury area.

12.1.2 With regards to traffic and transport, the main issues as a result of the Proposed Scheme are traffic generated during construction and the closures of both roads and Public Rights of Way (PRoW). These closures are either temporary or in some cases permanent, with associated diversions. Affects also arise from the short term closure of the Princes Risborough to Aylesbury Line during construction.

12.1.3 The effects on traffic and transport have been assessed quantitatively, based on baseline conditions and future projection scenarios.

12.1.4 A detailed report on traffic and transport and surveys undertaken within the area is contained in Volume 5: Appendix TR-001-000, Transport Assessment.

12.1.5 Figure 2 shows the location of the key transport infrastructure within this area.

12.1.6 Engagement has been undertaken with the relevant highway authority Buckinghamshire County Council (BCC).

12.2 Scope, assumptions and limitations

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

12.2.2 The study area includes: the A41 Bicester Road, A413 Wendover Road/Nash Lee Road, A4010 Risborough Road/Station Road, A418 Aylesbury Road/Oxford Road, A4157 Weedon Road/Elmhurst Road, B4009 Nash Lee Road, B4443 Lower Road and local roads that are affected by the Proposed Scheme.

12.2.3 The baseline forecast traffic flows for the future years 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.

12.2.4 It is assumed that bus services for the future years of assessment will be the same as those currently operating, since it is not possible to forecast how services may change in the future.

12.2.5 Apart from the manual reassignment of traffic onto the A4010 Stoke Mandeville bypass in the 2026 and 2041 scenarios, forecast future year traffic flows with and without the Proposed Scheme have been based on an approach that does not take account of wider effects, such as redistribution and reassignment of traffic, modal shift and peak spreading. As a consequence, adverse transport effects may be over-estimated.

12.3 Environmental baseline

Existing baseline

12.3.1 Existing conditions in the Stoke Mandeville and Aylesbury area have been determined through site visits, specially commissioned transport surveys, and liaison with relevant transport authorities and stakeholders to source traffic data, information on public transport, PRoW and accident data.

12.3.2 Traffic surveys were undertaken to establish current traffic flows on the road network subject to assessment, during September 2012 and February 2013. The surveys comprised of automatic traffic counts, junction turning counts and queue surveys. This was supplemented by traffic and transport data obtained from other sources where available, including from BCC.

12.3.3 PRoW surveys were undertaken in August 2012 and September 2012, to establish the nature of the PRoW and their usage by pedestrians, cyclists and equestrians (non-motorised users). The surveys included all PRoW and roads that will cross the Proposed Scheme, and any additional PRoW that will be affected by the Proposed Scheme. The surveys indicated that the majority of roads, footpaths, bridleways and cycleways that will cross the route are used by no more than 30 people per day except for a PRoW at FMA/1 (Bridleway), A4010 Risborough Road and SBH/2 (Bridleway) which were used by between 40-60 people per day, and the A418 Oxford Road that was used by no more than 80 people per day. The Proposed Scheme affects 17 PRoW within the Stoke Mandeville and Aylesbury area and crosses 13 of these. In addition to the 13 PRoW, the Proposed Scheme crosses four roads with potential for use by non-motorised users.

12.3.4 The main strategic roads and local roads that will be affected by the Proposed Scheme are the A41 Bicester Road, A413 Wendover Road/Nash Lee Road, A4010 Risborough Road/Station Road, A418 Aylesbury Road/Oxford Road, A4157 Weedon Road/Elmhurst Road, B4009 Nash Lee Road, B4443 Lower Road, Old Risborough Road, Marsh Lane and Nash Lee Lane.

12.3.5 Relevant accident data for the road network subject to assessment has been obtained from BCC for the three year period of 2009 to 2011. This has been assessed and any identified clusters have been examined. No significant accident clusters have been identified in the study area.

12.3.6 The following 12 public bus services operate along roads that were subject to traffic and transport assessment:

- Route 16 – connecting Aylesbury to Steeple Claydon and serving Waddesdon, Quainton, Grendon Underwood, Edgcott and Calvert;

- Route 18 – connecting Buckingham to Aylesbury serving Waddesdon, Grendon Underwood, Edgcott, Calvert, Steeple Claydon, as well as Twyford, Marsh Gibbon, Launton and Bicester;
- Route 50 – connecting Aylesbury to Ivinghoe and serving Stoke Mandeville, Wendover, Halton, Buckland and Little Brickhill;
- Route 55 – connecting Aylesbury to Amersham and Chesham and serving Stoke Mandeville, Wendover, Great Missenden and Little Missenden;
- Route 150 – connecting Aylesbury to Milton Keynes and serving Bicton, Wing, Leighton Buzzard, and Little Brickhill;
- Route 165 – connecting Aylesbury to Leighton Buzzard and serving Bicton, Wingrave, Cublington, and Wing;
- Route 300 – connecting High Wycombe to Aylesbury and serving Hughenden Valley, Haphill, Walters Ash, Lacey Green, Princes Risborough, Butlers Cross and Stoke Mandeville;
- Route 321 – connecting High Wycombe to Aylesbury and serving Princes Risborough, Butlers Cross and Stoke Mandeville;
- Route 613 – connecting Haddenham to Waddesdon and serving Hartwell and Aylesbury;
- Route 650 – connecting Aylesbury to Leighton Buzzard and serving Bicton and Wing;
- Route 653 – connecting Aylesbury to Wendover and serving Stoke Mandeville; and Broughton; and
- Route 655 – connecting Aylesbury to Wendover and serving Stoke Mandeville.

12.3.7 Three of these services operate along the A41 Bicester Road, with a combined peak frequency of up to three buses an hour. Three of these services operate along the A418 Aylesbury Road/Oxford Road, with a combined peak frequency of up to four buses an hour. Two of these services operate along the A4010 Risborough Road, with a combined peak frequency of up to five buses an hour. Four of these services operate along the A413 Wendover Road/Nash Lee Road, with a combined peak frequency of up to five services an hour.

12.3.8 Frequent rail services operate along the Princes Risborough to Aylesbury Line, serving stations within the area including Stoke Mandeville, Aylesbury and Aylesbury Vale Parkway.

12.3.9 There are no navigable waterways affected by the Proposed Scheme in this area and consequently these are not considered further in this assessment.

Future baseline

12.3.10 The future baseline traffic volumes have been calculated by applying growth factors derived from TEMPRO for the future years of 2021, 2026 and extrapolation to 2041. The factors have been derived for the individual road types and relevant wards and take account of the introduction of the A4010 Stoke Mandeville bypass in the 2026 and 2041 assessments.

12.3.11 No other changes to the traffic and transport baseline are anticipated in this area within the assessment.

Construction

12.3.12 Construction activities have been assessed against 2021 baseline traffic flows, irrespective of when they occur during the construction period. Future baseline traffic volumes in the peak hours in this area are forecast to grow by between around 14% and 19% by 2021 compared to 2012, depending on road type.

Operation (2026)

12.3.13 Future baseline traffic volumes in the peak hours in this area, are forecast to grow by between around 24% and 32% by 2026 compared to 2012, depending on road type.

Operation (2041)

12.3.14 Future baseline traffic volumes in the peak hours in this area, are forecast to grow by between around 48% and 66% by 2041 compared to 2012, depending on road type.

12.4 Effects arising during construction

Avoidance and mitigation measures

12.4.1 The following measures (as described in Section 2) have been included as part of the engineering design of the Proposed Scheme and will avoid or reduce effects on transport users:

- transporting construction materials and equipment along haul roads adjacent to the route of the Proposed Scheme where reasonably practicable to reduce lorry movements on the public highway;
- the majority of roads crossing the Proposed Scheme will be kept open during construction resulting in reduced diversions of traffic onto alternative routes;
- provision of temporary alternative routes and/or building structures early to maintain connectivity for PRoW closed during construction to minimise loss of amenity;
- HGV routeing as far as reasonably practicable along the strategic road network, and using designated access roads, as shown in Map TR-03-055 (Volume 5, Traffic and Transport Map Book);
- the need for rail possessions will be managed so that these take place for limited durations overnight and at weekends; and

- reducing daily travel by site workers by providing on site accommodation and welfare.

12.4.2 The draft CoCP (see Volume 5: Appendix CT-003-000/1) will include measures which seek to reduce the impacts and effects of deliveries of construction materials and equipment, including construction lorry trips during peak background traffic periods. The draft CoCP includes HGV management and control measures.

12.4.3 Where reasonably practicable, the number of private car trips to and from the site (both workforce and visitors) will be reduced by encouraging alternative modes of transport or vehicle sharing. This will be supported through an over-arching framework travel plan[94] that will require travel plans to be used, along with a range of potential measures, to mitigate the impacts of traffic and transport movements associated with construction of the Proposed Scheme. As part of this, a construction workforce travel plan will be put into operation with the aim of reducing workforce commuting by private car, especially sole occupancy car travel. This will encourage the use of sustainable modes of transport or vehicle sharing.

12.4.4 The measures in the draft CoCP (Section 14.2) will include clear controls on vehicle types, hours of site operation, and routes for heavy goods vehicles, to reduce the impacts of road based construction traffic. In order to achieve this, generic and site specific management measures will be implemented during the construction of the Proposed Scheme on or adjacent to public roads, bridleways, footpaths and other PRoW affected by the Proposed Scheme as necessary.

12.4.5 Specific measures will include:

- the core site operating hours will be 08:00-18:00 on weekdays and 08:00-13:00 on Saturdays and site staff and workers will, therefore, generally arrive before the morning peak hour and depart after the evening peak hour (although the assessment has assumed that some of work journeys to the construction sites take place within the morning and evening peak hours to reflect a reasonable worst case scenario (draft CoCP, Section 5); and
- excavated material will be reused wherever reasonably practicable along the alignment of the Proposed Scheme which will reduce the effects of construction vehicles on the public highway (draft CoCP, Section 14).

Assessment of impacts and effects

Temporary effects

12.4.6 The following section considers the impacts on traffic and transport and the consequential effects resulting from construction of the Proposed Scheme.

12.4.7 The temporary traffic and transport impacts within this area will be:

- construction vehicle movements to/from the construction site compounds;

[94] Construction and operational travel plans will promote the use of sustainable transport modes as appropriate to the location and types of trip. They will include measures such as: provision of information on and promotion of public transport services; provision of good cycle and pedestrian facilities; liaison with public transport operators; promotion of car sharing; and the appointment of a travel plan coordinator to ensure measures are in place and are effective.

- permanent road closures and associated diversions, including the A4010 Stoke Mandeville bypass; and
- PRoW closures and associated diversions.

12.4.8 Construction vehicle movements required to construct the Proposed Scheme include delivery of plant and materials, movement of excavated materials and site worker trips.

12.4.9 Details of construction compounds are provided in Section 2. The duration of when there will be busy transport activity at each site is shown in Table 18. This represents the periods when the construction traffic flows will be greater than 50% of the peak flows. Also shown is the estimated number of daily vehicle trips during the peak month of activity. The lower end of the range shows the average number of trips in the busy period and the upper end shows the average during the peak month.

Table 18: Typical vehicle trip generation from construction site compounds in this area

Compound Type	Location	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/ Light goods vehicles (LGV)	HGV
Satellite	Risborough Road	A4010 Risborough Road, A4129, A418 Thame Road and/or A4010 Risborough Road, B4009	2017	Three years	19 months	150-200	10-20
Satellite	Princes Risborough to Aylesbury rail overbridge	Haul road from A418 Oxford Road via A41	2017	Two years and nine months	Eight months	100-120	10-20
Satellite	Princes Risborough to Aylesbury rail overbridge (west) (rail systems)	Via the Princes Risborough to Aylesbury Line or the Princes Risborough to Aylesbury rail overbridge satellite compound	2018	Nine months			
Satellite	Princes Risborough to Aylesbury rail	Via the Princes Risborough to					

Compound Type	Location	Access to/from compound	Indicative start/set up date	Estimated duration of use (Years)	Estimated duration with busy vehicle movements (Months)	Average daily combined two-way vehicle trips during busy period and within peak month of activity	
						Cars/ Light goods vehicles (LGV)	HGV
	overbridge (east) (rail systems)	Aylesbury Line					
Satellite	A418 Oxford Road overbridge and Sedrup express feeder auto-transformer station	A418 Oxford Road, A4146, A421 and/or A418 Oxford Road to Aylesbury, A41 Bicester Road and or/ A418 Oxford Road/Aylesbury Road/ Thame Road	2018	Six years and three months	13 months	10-20	710-730
Satellite	Thame Valley viaduct	Haul road from A41 Bicester Road, A418 Oxford Road/Aylesbury Road, A4146, A421	2018	Two years and six months	21 months	110-160	40-50
Main	A41 Bicester Road Embankment /Putlowes auto-transformer station	A41 Bicester Road	2017	Seven years	22 months	190-260	10-20

12.4.10 Information on the indicative construction programme and methodology is provided in Section 2 that illustrates how the phasing of activities at different compounds will generally be staggered and that construction activities at individual compounds may not occur over the whole duration presented in Table 18. Consequently the peak traffic movements will not generally occur at the same time, although in some instances there may be some overlap.

12.4.11 Where construction routes serve more than one construction compound, the combined vehicle movements have been assessed.

12.4.12 Construction of the Proposed Scheme is expected to result in changes in daily traffic flows due to works and construction vehicles accessing worksites. There is also expected to be changes in traffic resulting from the permanent road closures associated with the construction of the Stoke Mandeville bypass.

12.4.13 These temporary changes in traffic flows will lead to significant delays to vehicle users and congestion[95] at the following junctions:

- A41 Bicester Road with Aylesbury Way Parkway (moderate adverse effect);
- A41 Bicester Road with Jackson Road and Dickins Way (moderate adverse effect);
- A41 Bicester Road with Rabans Lane (moderate adverse effect);
- A41 Bicester Road with Meadowcroft (moderate adverse effect);
- A41 Bicester Road with Broadfields (moderate adverse effect)
- A418 Oxford Road with Coldharbour Way (major adverse effect);
- A418 Oxford Road with Ellen Road (major adverse effect);
- A41 Bicester Road with Griffin Lane (moderate adverse effect);
- A418 Oxford Road with Churchill Avenue and Fowler Road (major adverse effect);
- A41 Bicester Road with A4157 Weedon Road and A41 Gatehouse Road (moderate adverse effect); and
- A418 Oxford Road with A41 Gatehouse Rd and A41 Friarage Road (major adverse effect).

12.4.14 There will be permanent effects from increased travel distance, due to traffic diversions associated with permanent road closures as follows, and these are reported in Section 12.5. These will include:

- the stopping up of A4010 Risborough Road requiring permanent diversion via the proposed A4010 Stoke Mandeville bypass and the B4443 Lower Road;
- the stopping up of Old Risborough Road requiring permanent diversion via the proposed A4010 Stoke Mandeville bypass and B4443 Lower Road; and
- the stopping up of Marsh Lane requiring permanent diversion via proposed A4010 Stoke Mandeville bypass.

[95] In assessing significant effects of traffic changes on congestion and delays, a major adverse effect occurs where traffic flows at a junction will be beyond or very close to capacity with the Proposed Scheme and the increases in traffic due to the Proposed Scheme will be such as to substantially increase queues and delays on a routine basis at peak times. A moderate adverse effect will occur when traffic flows at a junction will be approaching or at capacity with the Proposed Scheme a modest increases in traffic will increase the frequency of queues and more substantial delays. A minor adverse effect occurs when traffic flows at a junction are not generally exceeding capacity with the Proposed Scheme but the increase in flows will result in occasional queues and delays to small increases in existing delays.

12.4.15 Construction of the Proposed Scheme is expected to result in substantial increases in daily traffic flows (i.e. more than 30% for HGV or all vehicles) and these will cause a significant increase in traffic related severance[96] for non-motorised users in the following locations:

- A41 Bicester Road, west of A418 Oxford Road (moderate adverse effect) - increase in HGV flow; and
- A418 Oxford Road, between Thame and Aylesbury (major adverse effect) - increase in HGV flow.

12.4.16 These traffic flow increases will not result in increases in congestion and significant delays except those identified above.

12.4.17 Utilities works, including diversions, have been assessed in detail where they are major and where the traffic and transport impacts from the works separately, or in combination with other works, are greater than other construction activities arising within the area. More minor utilities works are expected to result in only localised traffic and pedestrian diversions, which will be of short term duration. No additional significant effects are expected due to utilities works.

12.4.18 No significant effects on parking or loading have been identified during construction of the Proposed Scheme in this area.

12.4.19 The effect on accidents and safety risk will not be significant as there are no locations where there are both clusters of accidents and substantial increases in traffic during construction.

12.4.20 The stopping up of the A4010 Risborough Road will result in the permanent diversion of the number 300 and 321 bus services, the impacts and consequential effects of these permanent diversions are assessed in Section 12.5.

12.4.21 The construction of the Proposed Scheme will require a number of rail possessions on the Princes Risborough to Aylesbury Line in the area that will affect some users of passenger services stopping at Stoke Mandeville, Aylesbury and Aylesbury Vale Parkway. These possessions will also affect users in adjacent CFAs. However, the possessions will be short-term and generally take place during mid-week nights or weekends. Therefore the effects of these possessions on rail users in this area and other CFAs will not be significant.

[96] In the context of this Traffic and Transport section, Severance is used to relate to a change in ease of access for non-motorised users due to, for example, a change in travel distance or travel time or a change in traffic levels on a route that makes it harder for non-motorised users to cross. A reference to severance does not imply a route is closed to access.

12.4.22 Temporary PRoW diversions in this area during construction will have minor adverse effects for non-motorised users due to the temporary PRoW diversions and increased travel distance at SBH/32 (footpath), SBH/34 (Footpath), SBH/27 (Footpath), SBH/19 (Bridleway), SMA/9 (Footpath), ELL/2 (Footpath), ELL/8 (Footpath), and ELL/20 (Footpath) with the length of diversion generally being approximately 100 metres, apart from ELL/2 (Footpath) and ELL/8 (Footpath) where the length of the diversion is approximately 400 metres. There will be moderate adverse effects due to the closure of SMA/16/2 (Footpath) - Round Aylesbury Walk, SMA/16/3 (Footpath) - Round Aylesbury Walk, with the diversions being approximately 4km in length, and at SMA/5/2 (Footpath), where the length of diversion is approximately 1.5km.

12.4.23 There will be no effects from disruption at stations or interchanges from construction of the Proposed Scheme in this area.

Cumulative effects

12.4.24 The assessment includes cumulative effects of planned development during construction by taking this into account within the background traffic growth.

12.4.25 The assessment also includes in-combination effects by taking into account traffic and transport impacts of works being undertaken in neighbouring areas.

12.4.26 From the neighbouring areas to the north, including the Waddesdon and Quainton (CFA12) and the Calvert, Steeple Claydon, Twyford and Chetwode (CFA13), cumulative average construction traffic flows of approximately 60 cars/LGV and 20 HGV per day (two-way) have been included in the assessment for this area.

12.4.27 From the neighbouring areas to the south, including the Dunsmore, Wendover and Halton (CFA10), the Central Chilterns (CAF9) and the Chalfonts and Amersham (CFA8), cumulative average construction traffic flows of approximately 230 cars/LGV per day (but no HGVs) have been included in the assessment for this area.

Permanent effects

12.4.28 Any permanent effects of construction, including those arising from the introduction of the A4010 Stoke Mandeville bypass have been considered in the operations phase for traffic and transport in Section 12.5. This is because the impact and effects of on-going increases in travel demand and the wider effects of the operations phase need to be considered together.

Other mitigation measures

12.4.29 The implementation of the draft CoCP (see Volume 5: Appendix CT-003-000/1) in combination with the framework travel plan and the construction workforce travel plan will, to some degree, mitigate the transport related effects during construction of the Proposed Scheme. The reductions in adverse effects arising from the travel plan measures have not been included in the assessment, which will mean the adverse effects may be over-stated.

12.4.30 Rail replacement services will also be provided where necessary when rail possessions are in place on the Princes Risborough to Aylesbury Line. Where reasonably practicable rail possessions will be scheduled to coincide with other planned rail possessions for engineering and maintenance works on the same line to reduce additional disruption to rail users.

12.4.31 No further traffic and transport mitigation measures during construction of the Proposed Scheme are considered necessary based on the outcome of this assessment.

Summary of likely significant residual effects

12.4.32 Increased traffic during the most intensive periods of construction will also potentially cause additional intermittent traffic congestion and delay at a number of junctions in the area, including; A41 Bicester Road with Aylesbury Way Parkway; A41 Bicester Road with Jackson Road and Dickins Way; A41 Bicester Road with Rabans Lane; A41 Bicester Road with Meadowcroft; A41 Bicester Road with Broadfields; A418 Oxford Road with Coldharbour Way; A418 Oxford Road with Ellen Road; A41 Bicester Road with Griffin Lane; A418 Oxford Road with Churchill Avenue and Fowler Road; A41 Bicester Road with A4157 Weedon Road and A41 Gatehouse Road and A418 Oxford Road with A41 Gatehouse Road and A41 Friarge Road.

12.4.33 Increased traffic during the most intensive periods of construction, particularly HGV traffic, will affect non-motorised users crossing and using; A41 Bicester Road, West of A418 Oxford Road, and A418 Oxford Road, between Thame and Aylesbury.

12.4.34 Temporary realignment of 11 PRoW, including roads, (SBH/32, SBH/34, SBH/27, SBH/19, SMA/9, ELL/2, ELL/8, ELL/20, SMA/16/2, SMA/16/3 and SMA/5) during construction will increase travel distances due to the associated diversions for relatively few non-motorised users.

12.4.35 The significant effects that result from construction of the Proposed Scheme are shown on Map Series TR-03-055 (Volume 5, Traffic and Transport Map Book).

12.5 Effects arising from operation

Avoidance and mitigation measures

12.5.1 The following measures have been included as part of the design of the Proposed Scheme and will avoid or reduce impacts on transport users, these include:

- retaining roads crossing the Proposed Scheme in their current location, or where not, alternative routes such as the A4010 Stoke Mandeville bypass are provided; and
- retaining PRoW crossing the Proposed Scheme, with localised realignments kept to a minimum length where reasonably practicable.

Assessment of impacts and effects

12.5.2 The following section considers the impacts on traffic and transport and the consequential effects resulting from the operational phase of the Proposed Scheme (as described in Section 2.4) of this report.

12.5.3 The operational traffic and transport impacts within this area are:

- permanent road closures and associated diversions, including the A4010 Stoke Mandeville bypass;
- permanent diversion of bus services; and
- PRoW realignments.

12.5.4 Occasional traffic may access areas of the Proposed Scheme for maintenance purposes. However, these infrequent vehicle movements are expected to be very low and will not have a significant effect.

12.5.5 The introduction of the A4010 Stoke Mandeville bypass in combination with the stopping up of A4010 Risborough Road, Old Risborough Road and Marsh Lane will result in a moderate beneficial effect on delays to vehicle users and congestion at the A4010 Risborough Road/B4443 Lower Road junction.

12.5.6 The introduction of the A4010 Stoke Mandeville bypass will result in the following significant effects on vehicle occupants from diversions:

- permanent stopping up of Marsh Lane will require a traffic diversion of up to 3km via the A4010 Stoke Mandeville bypass and B4443 Lower Road, resulting in a moderate adverse effect;
- permanent stopping up of Old Risborough Road, will require a traffic diversion of up to 4.8km via A4010 Stoke Mandeville bypass and B4443 Lower Road, resulting in a minor adverse effect; and
- permanent stopping up of A4010 Risborough Road through Stoke Mandeville, north of A4010 Stoke Mandeville bypass will require a traffic diversion of up to 4.8km via Stoke Mandeville bypass and B4443 Lower Road, resulting in a moderate adverse effect.

12.5.7 The introduction of the A4010 Stoke Mandeville bypass in combination with the stopping up of A4010 Risborough Road, Old Risborough Road and Marsh Lane will result in substantial changes in traffic flows (i.e. more than 30% for HGV or all traffic) that will cause a significant change in traffic related severance, for non-motorised users in the following locations:

- Marsh Lane, east of A4010 Stoke Mandeville bypass (moderate beneficial effect) – decrease in HGV flow as well as all traffic flow;
- B4443 Lower Road, south of the A4010 Stoke Mandeville bypass (major beneficial effect) – decrease in HGV flow as well as all traffic flow;
- Old Risborough Road (moderate adverse effect) – increase in all traffic flow; and

- A4010 Risborough Road, north of the A4010 Stoke Mandeville bypass (major beneficial effect) – decrease in HGV flow as well as all traffic flow.

12.5.8 No significant effects on parking or loading have been identified in the area resulting from the operation of the Proposed Scheme.

12.5.9 The effects on accidents and safety risks will not be significant as there are no locations where there are both existing accident clusters and substantial increases in traffic in this area.

12.5.10 The introduction of the A4010 Stoke Mandeville bypass in combination with the stopping up of A4010 Risborough Road, Old Risborough Road and Marsh Lane will result in a major adverse effect on the 300 and 321 bus services, due to the diversion of approximately 4km onto the A4010 Stoke Mandeville bypass.

12.5.11 There will be minor adverse effects on non-motorised users from increased travel distance due to the permanent PRoW realignment at FMA/2 (public Footpath), FMA/1 (public Footpath), A418 Oxford Road, SMA/16 (public Footpath), SMA/11 (public Footpath), Marsh Lane, SMA/8 (public Footpath), Old Risborough Road, and SMA/5 (public Footpath). The majority of the realignments will be between 100m and 500m in length, apart from the FMA/1 (public Footpath), where the realignment will be approximately 900m.

12.5.12 The impacts and consequential effects of the operation of the Proposed Scheme in 2041 will be the same as described for 2026, having taken account of increased background traffic growth.

Cumulative effects

12.5.13 The assessment includes the cumulative effects of planned development during operation, by taking into account background traffic growth.

12.5.14 The assessment includes cumulative effects by taking into account transport impacts as a result of the Proposed Scheme in neighbouring areas. There will be, however, no additional traffic in this area resulting from the operation of the Proposed Scheme in neighbouring areas.

Other mitigation measures

12.5.15 No other mitigation measures during operation of the Proposed Scheme are considered necessary based on the outcome of this assessment.

Summary of likely significant residual effects

12.5.16 The A4010 Stoke Mandeville bypass will result in a decrease in traffic flow on; Marsh Lane, east of the A4010 Stoke Mandeville bypass; the B4443 Lower Road, south of the A4010 Stoke Mandeville bypass; and the A4010 Risborough Road, north of the A4010 Stoke Mandeville bypass that will have a beneficial effect on non-motorised users crossing and using these roads. Conversely, the stopping up of Old Risborough Road will increase traffic flow on this road south of the Proposed Scheme affecting the few non-motorised users crossing and using the road.

12.5.17 The A4010 Stoke Mandeville bypass will result in a reduction in traffic flow at the A4010 Risborough Road/B4443 Lower Road junction, which will potentially reduce intermittent traffic congestion and delay at this location.

12.5.18 Permanent stopping up of A4010 Risborough Road, Marsh Lane and Old Risborough Road will cause additional delay for users of these roads due to the additional travel distance required to use the A4010 Stoke Mandeville bypass.

12.5.19 The permanent stopping up of A4010 Risborough Road will also require the diversion of two bus services, resulting in delays to bus users due to the additional travel distance required to use the A4010 Stoke Mandeville bypass.

12.5.20 Permanent closure of nine PRoW, including roads, (FMA/2/1, FMA/1/1, A418 Oxford Road, SMA/16/1, SMA11/2, Marsh Lane, SMA/8/2, Old Risborough Road and SMA/5/1) to accommodate the Proposed Scheme and the A4010 Stoke Mandeville bypass will increase travel distances due to the length of diverted or alternative routes for non-motorised users.

12.5.21 The significant effects that result from operation of the Proposed Scheme from 2026 and 2041 are shown on Map TR-04-066 (Volume 5, Traffic and Transport Map Book).

13 Water resources and flood risk assessment

13.1 Introduction

13.1.1 This section provides a description of the current baseline for water resources including surface water, groundwater and flood risk. It then reports on the likely impacts and significant effects on these aspects as a result of the construction and operation of the Proposed Scheme.

13.1.2 The main environmental features of relevance to water resources and flood risk include:

- the River Thame and its associated floodplain;
- the Stoke Brook, that is a main river and its tributaries;
- the Sedrup Ditch and Lower Hartwell Ditch, that are main rivers and their tributary streams close to Lower Hartwell;
- tributaries of the Fleet Marston Brook;
- a number of small brooks, field drains and ponds within 1km of the study area, including the Bear Brook, and a landscape which includes several watercourses and ponds between Upper and Lower Hartwell; and
- the Portland Group Principal aquifer and a number of Secondary aquifers.

13.1.3 Key environmental issues relating to water resources and flood risk include:

- the need for culverts and a viaduct crossing of the River Thame;
- the need for channel diversions at Stoke Brook;
- the potential impact on groundwater quality and private groundwater abstractions associated with aquifers in the Lower Greensand, Purbeck and Portland Groups;
- potential impacts on the risk of river flooding at the crossings of the Stoke Brook and its tributaries and the River Thame; and
- potential impacts on the risk of surface water flooding at the upper reaches of the Stoke Brook, and at the Sedrup Ditch and Lower Hartwell Ditch.

13.1.4 Volume 5: Appendix WR-001-000 contains a report on the route-wide effects including:

- generic assessments on a route-wide basis;
- stakeholder engagement;
- in combination effects;
- a draft operation and maintenance plan for water resources and flood risk;

- Water Framework Directive[97] (WFD) compliance assessment; and
- a route-wide Flood Risk Assessment (FRA).

13.1.5 Detailed reports on water resources and flood risk within this area are also contained in the Volume 5 appendices. These include:

- Appendix WR-002-011 Water Resources Assessment report;
- Appendix WR-003-011 Flood Risk Assessment; and
- Appendix WR-004-003 Hydraulic modelling report for the Stoke Brook to the south of Stoke Mandeville.

13.1.6 Maps WR-01 to WR-03 and WR-05 to WR-06 showing some of the details, environmental baseline and design features referred to in this report and those in Volume 5 are all contained in the Volume 5, Water Resources and Flood Risk Assessment Map Book.

13.1.7 Discussions have been held with the Environment Agency, Buckinghamshire County Council, Aylesbury Vale District Council, Wycombe District Council and the Canal & River Trust (formerly British Waterways).

13.2 Scope, assumptions and limitations

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

13.2.2 The spatial scope of the assessment was based upon the identification of surface water and groundwater features within 1km of the centre line of the route, except where there is clearly no hydraulic connectivity. For surface water features in urban areas, the extent was reduced to 500m. Outside of these distances it is unlikely that direct impacts upon the water environment will be attributable to the Proposed Scheme. Where works extend more than 200m from the centre line, for example at stations and depots, professional judgement has been used in selecting the appropriate limit to the extension in spatial scope required. For the purposes of this assessment this spatial scope is defined as the study area.

13.2.3 Site visits have been carried out for the following locations along the route:

- the Stoke Brook close to Stoke Mandeville, and further downstream to the south of Aylesbury, as part of the flood risk and surface water assessment (December 2012);
- the springs and feeder streams in the vicinity of Hartwell House, as part of the groundwater assessment of their connectivity with the nearby lake and watercourses (May 2013); and

[97] Water Framework Directive - Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, Strasbourg, European Parliament and European Council.

- the Lower Hartwell Ditch at Aylesbury Park Golf Club, Sedrup Ditch and the River Thame, as part of the flood risk and surface water assessment (May 2013).

13.2.4 WFD classification data has been made available by the Environment Agency. For surface water bodies that do not have a WFD status class shown in the relevant River Basin Management Plan (RBMP), the status class has been taken as the status class for the first downstream water body for which a status class is reported. Where groundwater does not have a WFD status class shown in the relevant RBMP, these are referred to as 'not assessed by the Environment Agency'.

13.2.5 Baseline surface water levels, flows and quality have not been monitored. The assessment is based on flows provided by publicly available National River Flow Archive[98] source used to establish the flows exceeded for 95% of the year (Q95 values) for study area catchments.

13.2.6 There are limited borehole records available along the route in the study area with which to understand the local geological and hydrogeological conditions likely to be encountered for areas of below ground construction. It is assumed that groundwater levels vary in a similar fashion to topography throughout the area, with groundwater level contours roughly parallel to topographic contours. The location of aquifers has been identified using geological base mapping.

13.2.7 Hydraulic modelling has been undertaken for the upper reaches of the Stoke Brook to the south of Stoke Mandeville, as presented in Volume 5: Appendix WR-004-003. The limitations associated with flood risk within this study area are described in detail in the FRA in Volume 5: Appendix WR-003-011.

13.3 Environmental baseline

Existing baseline – Surface water resources

Surface water features

13.3.2 All water bodies in this study area fall within the Thame and South Chilterns sub-catchment of the Thames River Basin District (RBD) as set out in the RBMP[99]. These are identified in Table 19.

13.3.3 The current surface water baseline is shown on maps WR-01-14 to WR-01-15 (Volume 5, Water Resources and Flood Risk Assessment Map Book) and all surface water features within the study area are assessed within Volume 5: Appendix WR-002-011. Table 19 includes features potentially affected by the Proposed Scheme.

[98] National River Flow Archive: www.ceh.ac.uk/data/nrfa.
[99] Environment Agency (2009), *River Basin Management Plan*, Thames River Basin District.

Table 19: Surface water features potentially affected by the Proposed Scheme

Water feature	**Location description (Volume 5 Water Resources and Flood Risk Map Book map reference)**	**Watercourse classification[100]**	**WFD water body and current overall status**	**WFD status objective (by 2027 as in RBMP)**	**Receptor value[101]**
Stoke Brook and tributaries	Will be crossed by the route five times near Stoke House (SWC-CFA11-02 to 06) and tributaries crossed at SWC-CFA11-01, SWC-CFA18 and SWC-CFA11-21 Crossed by the Proposed Scheme the A4010 Stoke Mandeville bypass (SWC-CFA11-19)	Main river	Stoke Brook Aylesbury (GB106039030320) Moderate	Good (by 2015)	High
Sedrup Ditch	Crossed by the route south of Walton Court (SWC-CFA11-08, 25 and 26)	Main river	No status class shown in RBMP – assumed status Moderate	No status class shown in RBMP – assumed status Good	Moderate
Hartwell Ditch	Crossed by the route, outlet from Hartwell House lake (SWC- CFA11-09)	Main river	No status class shown in RBMP – assumed status Moderate	No status class shown in RBMP – assumed status Good	Moderate
Lower Hartwell Ditch and drain	Crossed by the route within Aylesbury Park Golf Club (SWC-CFA11-10, 11, 30 and 31)	Ditch - Main river Drain - Ordinary watercourse	No status class shown in RBMP – assumed status Moderate	No status class shown in RBMP – assumed status Good	Moderate
Tributary of River Thame south of Bear Brook	Viaduct will cross tributary and pond (local fluvial flood defence structure) at SWC-CFA11-12	Ordinary watercourse	No status class shown in RBMP – assumed status Poor	No status class shown in RBMP – assumed status Good	Moderate
River Thame	Crossed by the route west of Aylesbury (SWC-CFA11-13)	Main river	Thame (Aylesbury to Scotsgrove Brook) (GB106039030370) Poor	Good	High
Bear Brook	Near Stoke Mandeville and Aylesbury. Confluence with River Thame 250m northeast of SWC-CFA11-13.	Main river	Bear Brook, Hartwell Ditch, at west Aylesbury (GB106039030350)	Good potential	High

[100] 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.

[101] For examples of receptor value see Table 43 in the addendum to the SMR (see Volume 5: Appendix CT-001-000/2).

Water feature	Location description (Volume 5 Water Resources and Flood Risk Map Book map reference)	Watercourse classification[100]	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value[101]
	Not crossed by the route		Poor Bear Brook and Wendover Brook (GB106039030380) Moderate		
Tributary of Fleet Marston Brook (field drain from Coney Hill and Fleet Marston Spinney)	Crossed by the route south of Fleet Marston (SWC-CFA11-15)	Ordinary watercourse	No status class shown in RBMP – assumed status Poor	No status class shown in RBMP – assumed status Good	Moderate
Drain from Upper and Lower Cranwell Farms (tributary of Fleet Marston Brook)	Near Fleet Marston and west of Aylesbury (SWC-CFA11-16)	Ordinary watercourse	No status class shown in RBMP – assumed status Poor	No status class shown in RBMP – assumed status Good	Moderate
Numerous small ponds within a 1km radius of the Proposed Scheme	Various locations (see Volume 5: Appendix WR-002-011 for details)	Not applicable	Not applicable	Not applicable	Low

Water Framework Directive status

13.3.4 The Environment Agency has assessed the current status and predicted overall quality under the WFD for the following water bodies in the study area:

- the 'Stoke Brook Aylesbury', which currently has a Moderate Status, to be Good by 2015;
- the Bear Brook (Bear Brook and Wendover Brook) is currently designated as a heavily modified water body at Moderate Status, with an objective of Good Potential by 2027;
- the Bear Brook (Hartwell Ditch at west Aylesbury) is currently designated as an artificial water body with a status of Poor Potential. It has a 2027 objective of Good Potential; and
- the River Thame (Aylesbury to Scotsgrove Brook) has a Poor Status. The objective for 2027 is Good Status.

Abstractions and discharges

13.3.5 There are no licensed surface water abstractions within 1km of the route in the study area[102]. There is the potential for unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.

13.3.6 The Environment Agency reports that there are 20 current consented surface water discharges within 1km of the route in the study area (see Volume 5, Appendix WR-002-011).

Existing baseline – groundwater resources

Geology and hydrogeology

13.3.7 The geological formations within this area are described further, with a schematic geological cross-section in Volume 5: Appendix WR-002-011.

13.3.8 The location of private abstractions, geological formations and indicative groundwater levels are shown on Map WR-02-011 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

13.3.9 A summary of the superficial and bedrock geology and hydrogeology is presented in Table 20. Unless otherwise stated, the geological groups listed are all crossed by the route.

Table 20: 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						
Diamicton	Very small patch in the north of the study area (western area crossed by route)	Till	Unproductive	Not assessed by Environment Agency	Not assessed by Environment Agency	Low
Head	Presence is very varied, tends to be higher elevations of the sides of watercourses such as River Thame, Bear Brook and tributaries, (crossed by route in several locations)	Clay, silt, sand and gravel	Secondary undifferentiated	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
River Terrace Deposits	Small patches adjacent to alluvium and watercourses (crossed by route	Sand and gravel	Secondary type A	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate

[102] Surface water abstractions for public supply are not included.

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value
	on southern side of River Thame flood plain)					
Alluvium	Largely limited to the course of the River Thame, Bear Brook and Stoke Brook	Clay, silt, sand and gravel	Secondary type A	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
Bedrock						
Gault Formation, or undifferent-iated Gault and Upper Greensand Formation (Selbourne Group)	In the south east of the study area under Stoke Mandeville and southern area of Aylesbury (crossed by route)	Stiff clay (Gault Formation)	Unproductive	Not assessed by Environment Agency	Not assessed by Environment Agency	Low
Lower Greensand Group	Limited outcrop in the south east of the study area (not crossed by route)	Variably cemented to loose fine grained sandstone	Secondary type A	Headington Corallian[103] Good	Good	Moderate
Wealden Group (Whitchurch Sand Formation)	Minor outcrop in the southern part of the study area (very small area crossed by route)	Unconsolidated fine to medium sand, beds of sandstone, silt, clay and mudstone	Secondary type A	Headington Corallian Good	Good	Moderate
Purbeck Group (Purbeck Strata)	Minor outcrops in the south east of the study area (very small area crossed by route adjacent to Whitchurch Sand Formation)	Interbedded mudstones, limestones and evaporites	Secondary undifferentiated	Not assessed by Environment Agency	Not assessed by Environment Agency	Moderate
Portland Group (Portland Stone Formation)	Minor outcrops in the south east of the study area, usually adjacent to Purbeck Group (limited crossing by route)	Limestone, some mudstones and shales	Principal	Headington Corallian Good	Good	High
Portland Group (Portland Sand Formation)	Very minor outcrop in the mid-southern study area	Finely crystalline dolomite above mixed	Secondary type A	Headington Corallian Good	Good	Moderate

[103] The Headington Corallian groundwater body comprises the Lower Greensand Group, Wealden Group and Portland Group.

Geology	Distribution	Formation description	Aquifer classification	WFD water body and current overall status	WFD status objective (by 2027 as in RBMP)	Receptor value
		carbonate and siliclastic sediments				
Ancholme Group (Kimmeridge Clay Formation)	Widespread, from the middle to the north west of the study area (crossed by route from area of Hartwell House to Fleet Marston Spinney north of River Thame)	Mudstones, siltstones and cementstone beds, locally sands and silts	Unproductive	Not assessed by Environment Agency	Not assessed by Environment Agency	Low
Ancholme Group (Ampthill Clay Formation)	Outcrops in the northern part of the study area (crossed from Fleet Marston Spinney to study area boundary)	Mudstone, silty with argillaceous limestone nodules	Unproductive	Not assessed by Environment Agency	Not assessed by Environment Agency	Low

Superficial deposits

13.3.10 Superficial deposits are absent over the majority of the study area. The following deposits located along the route comprise Secondary aquifers at the following locations:

- River Terrace Deposits (Secondary A aquifer) consisting of sands and gravels, and Alluvium, consisting of clay, silt and sand associated with the River Thame, Stoke Brook, Bear Brook and their tributaries; and
- four minor areas of Head Deposits consisting of silt, sand and clay, located to the north-east of Standall's Farm, at Lower Hartwell, south of Putlowes and at Fleet Marston.

13.3.11 The superficial aquifers are limited in area and depth and, as such, are unlikely to support any substantial groundwater abstractions. However, they are likely to be in continuity with local watercourses.

Bedrock aquifers

13.3.12 Generally, from south east to north west, the underlying bedrock comprises the following sequence:

- Gault Formation, or undifferentiated Gault and Upper Greensand Formation (Selbourne Group), comprising mudstones in the Gault Formation and sandstones predominantly in the upper Greensand;
- Wealden Group (sand, beds of sandstone, silt, clay and mudstone)
- Purbeck Limestone Group;

- Portland Group consisting of the Portland Stone and Portland Sand Formations; and
- Ancholme Group consisting of Kimmeridge Clay and Ampthill Clay.

13.3.13 In summary the southern part of the study area has some aquifers outcropping under the route but the majority of the middle and northern part of the study area the route will cross non-aquifers (unproductive strata).

13.3.14 There are two north-west to south-east trending faults running approximately parallel to the route from Aylesbury to Fleet Marston (see Map WR-02-011). The faults are located at least 130m from the route, extending obliquely away from the route. In addition, there is a fault just north of Lower Hartwell which runs approximately perpendicular to the route but finishes before it intersects the route. These are not intersected by the Proposed Scheme.

Water Framework Directive status

13.3.15 No WFD classification has been given by the Environment Agency to the superficial deposits.

13.3.16 The Lower Greensand, Portland and Wealden groups are referred to jointly as the Headington Corallian WFD water body and is covered by the Thames RBMP. The current status is Good and the WFD objective is to maintain Good Status by 2015.

Abstractions and permitted discharges

13.3.17 The Environment Agency reports that there are no licensed abstractions for public water supply (PWS) from groundwater within 1km of the route and no source protection zones (SPZ) will be crossed.

13.3.18 The Environment Agency reports that there are two licensed groundwater abstractions, for non-PWS uses, within 1km of the route, as shown in Map WR-02-11 (Volume 5, Water Resources and Flood Risk Assessment Map Book). Both licensed abstractions are from wells. One well is approximately 700m west of the Aylesbury north cutting, just north of Upper Hartwell. The other well is about 400m north -east of the Thame Valley viaduct cutting, on the western side of Aylesbury near Hayden Mill Farm. There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20 cubic metres per day. Further details are given in Volume 5: Appendix WR-002-011.

13.3.19 There are no reported private, unlicensed groundwater abstractions in this study area.

13.3.20 The Environment Agency reports that there are twenty consented discharges to groundwater within 1km of the Proposed Scheme through this study area (details in Volume 5: Appendix WR-002-011).

Surface water/groundwater interaction

13.3.21 In addition to the interaction with some superficial deposits, springs are present along the boundary of the Kimmeridge Clay with the Portland Sand, particularly around Sedrup and Upper Hartwell. The flow from these springs is low, even following winter rainfall, indicating that there is limited groundwater in the Portland Sand. This is to be expected as there is limited presence of the Portland Sand in the area.

Water dependent habitats

13.3.22 There are no areas with statutory ecological designations in relation to surface water or groundwater in the study area. No potential water dependent habitats other than the water bodies described in Table 19 have been identified.

Existing baseline – flood risk

River flooding

13.3.23 The agreed data set for river flooding is the Environment Agency Flood Zone Mapping, as shown on Map WR-01-014 and Map WR-01-015 (Volume 5, Water Resources and Flood Risk Assessment Map Book). All surface water crossing location references (e.g. SWC-CFA11-02) are also shown on these maps.

13.3.24 The route will cross the Stoke Brook, Sedrup Ditch, Lower Hartwell Ditches and River Thame.

13.3.25 The Stoke Brook (including its millstream at Stoke House) is a main river and will be crossed a total of five times by the route to the south of Stoke Mandeville (SWC-CFA11-02 to SWC-CFA11-06). Ancillary embankments and construction works will cross the Stoke Brook and its tributaries at several other locations. At the existing culvert beneath the A4010 Risborough Road, the Stoke Brook has a catchment size of approximately 5km^2. Flood Zone 2 and 3 overlie one another and comprise the same area. The route will therefore occupy approximately 16,500m^2 of these Flood Zones.

13.3.26 The flood zones downstream of the Princes Risborough to Aylesbury Line are based on existing hydraulic modelling for the Stoke Brook undertaken by the Environment Agency. The extent of flooding is predicted to remain predominantly in-channel for flood events up to a 1 in 1,000 years return period (0.1% annual probability).

13.3.27 The existing hydraulic model held by the Environment Agency does not extend upstream of the Princes Risborough to Aylesbury Line and therefore in order to better understand the existing risk posed by the Stoke Brook, a bespoke hydraulic model has been created as part of the FRA. The modelling has confirmed that flood flows are predominantly confined to the channels of the Stoke Brook for the 1 in 100 years return period (1% annual probability) flood event. This is consistent with the modelled flood zones downstream of the Princes Risborough to Aylesbury Line. Further details on the hydraulic modelling are presented in the flood risk assessment (see Volume 5: Appendix WR-003-011) and maps showing the extent of flooding included in the map series WR-05 and WR-06 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

13.3.28 The land use within the floodplain in the vicinity of the Proposed Scheme is largely made up of arable farm land and pasture (moderate value receptors) with the exception of three residential properties at The Paddock, Brook Farm and Moat Farm (high value receptors).

13.3.29 According to the Aylesbury Vale District Council Strategic Flood Risk Assessment (SFRA)[104], the Stoke Brook was flooded in 1947, 1954, 1963 and 1968 downstream of the Princes Risborough to Aylesbury Line to its confluence with the River Thame. Channel improvement works were undertaken in 1977 and 1978 to alleviate flooding in the Stoke Brook, including a diversion of the Hartwell Ditches directly to the Bear Brook.

13.3.30 The Sedrup Ditch (Map WR-01-014 SWC-CFA11-08) is a main river and has a catchment area of 2km^2 at the crossing point for the route. Flow in the Sedrup Ditch is predicted to remain in-channel in all conditions up to and including the 1 in 1000 years return period (0.1% annual probability) event. The land use in the floodplain immediately upstream of the crossing is woodland and arable land (moderate value receptor).

13.3.31 The Lower Hartwell Ditch and its tributary (Map WR-01-014 SWC-CFA11-09 and SWC-CFA11-10) are designated as main rivers and form part of a system of land drainage ditches in Aylesbury Park Golf Club. The catchment is approximately 1km2. Flood Zone 3 is shown to remain in-channel. Flood Zone 2, however, extends outside the channel and as such, approximately 5,800m2 of Flood Zone2 will be occupied by the Proposed Scheme. In this area, Flood Zone 2 has been delineated using the approximate extents of historical flooding that was recorded in 1947 on the Stoke Brook and its tributaries. This flooding is believed to have occurred as a result of a combination of high groundwater levels and overland flows. The primary land use in the floodplain in the vicinity of the route is the leisure facilities of Aylesbury Park Golf Club (moderate value receptor).

13.3.32 The River Thame (Map WR-01-015 SWC-CFA11-13) has a catchment at the route crossing of 215km^2. The route will cross the River Thame downstream of its confluences with the Bear Brook and Fleet Marston Brook. The land use in the floodplain in the vicinity of the Proposed Scheme is arable farm land and pasture (moderate value receptor).

13.3.33 There is a large floodplain extent associated with the River Thame. A flood storage area to the east of the crossing is believed to have been constructed as mitigation for the development of the Fairford Leys urban extension to the south-west of Aylesbury. Including the flood storage area, the route (which will be on a viaduct) will cross 790m of Flood Zone 3.

[104] Royal Haskoning and AVDC (2007), *Aylesbury Vale SFRA – Level 1 Report*.

Surface water flooding

13.3.34 The Buckinghamshire Preliminary Flood Risk Assessment[105] (PFRA) states that the locally agreed surface water flooding dataset is the Environment Agency Flood Map for Surface Water (FMfSW), which is shown in Map WR-01-014 and Map WR-01-015 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

13.3.35 There are two historical records of surface water flooding in the Buckinghamshire PFRA within the study area: on the B4443 Lower Road to the south of Stoke Mandeville Hospital and on the A41 Bicester Road near the recently constructed housing development opposite Aylesbury Vale Parkway park and ride.

13.3.36 There are areas on the FMfSW within this study area that have a high risk of surface water flooding for rainfall events up to and including the 1 in 200 (0.5% annual probability) rainfall event. These include areas outside the floodplain of the Stoke Brook and Sedrup Ditch, and areas associated with field drains close to Fleet Marston (Map WR-01-015, SWC-CFA11-15 and SWC-CFA11-16).

Sewer flooding

13.3.37 The agreed datasets for sewer flooding are Thames Water records in the Buckinghamshire PFRA and the Aylesbury Vale District Council SFRA. However, neither of these reports contain any records of sewer flooding within the study area.

13.3.38 The route will not pass through any significantly urbanised areas within the study area. Consequently, there is currently a low risk of flooding from sewers.

Artificial water bodies

13.3.39 The agreed dataset for flooding due to reservoir failure is the Environment Agency Reservoir Inundation Map[106], as shown on Map WR-01-014 (Volume 5, Water Resources and Flood Risk Assessment Map Book).

13.3.40 Flooding from artificial water bodies, such as canals and reservoirs, although unlikely, may occur as a result of failure of a retaining structure that impounds water.

13.3.41 The route will cross an area shown on the Environment Agency Reservoir Inundation Maps to have an extremely low risk of flooding associated with a failure of the Tring Reservoirs, located about 5km to the east of the study area. The modelled flowpaths from the Tring Reservoirs follow the course of the River Thame and its floodplain.

Groundwater flooding

13.3.42 The agreed dataset for groundwater flooding is the Buckinghamshire PFRA.

[105] Jacobs (2011), *Buckinghamshire Preliminary Flood Risk Assessment*.
[106] Environment Agency (2013), *Reservoir Inundation Mapping*: http://maps.environment-agency.gov.uk/wiyby/wiybyController?topic=reservoir&layerGroups=default&lang=_e&ep=map&scale=8&x=480198.24999999994&y=213224.83333333343. Last accessed: August 2013.

13.3.43 The Buckinghamshire PFRA shows that there are areas susceptible to groundwater flooding associated with local superficial deposits along the Stoke Brook, at the Aylesbury Park Golf Club, across the River Thame valley, and near Fleet Marston. All of these areas will be crossed on embankment or viaduct and therefore not at risk of groundwater flooding. The risk of groundwater flooding is not considered further within this assessment. The Aylesbury Vale District Council SFRA states that there is a low risk of groundwater flooding in the study area.

Future baseline

13.3.44 Section 2.1 and Appendix CT-004-000 identify developments with planning permission or sites allocated in adopted development plans, on or close to the Proposed Scheme. These are termed 'committed developments' and will form part of the baseline for the operation of the Proposed Scheme. The potential cumulative effects arising from committed developments in relation to water resources and flood risk have been considered as part of this assessment of the construction and operation of the Proposed Scheme.

13.3.45 The Berryfields MDA development is to be designed and built in accordance with the requirements of the National Planning Policy Framework (NPPF)[107], development plans and other relevant water resources and flood risk legislation and guidance. As such committed developments are likely to have a neutral effect on the water resources and flood risk baseline.

13.3.46 WFD future status objectives are set out in Table 19 and Table 20. These changes are not considered to result in significant changes to the reported effects from the Proposed Scheme.

Climate change

13.3.47 Current projections to the 2080s indicate that climate change may affect the future baseline against which the impacts of the Proposed Scheme on surface water and groundwater resources have been assessed. There may be changes in the flow and water quality characteristics of surface water and groundwater bodies as a result of changes in climate. However, except for flood flows described below, these changes are not considered to result in the reported effects from the Proposed Scheme changing in significance

13.3.48 Current projections indicate that there will be more frequent, higher intensity rainfall events in the future. The probability and severity of surface water flooding could therefore increase as surface water drainage systems fail to cope with more frequent, higher intensity storms. Peak river flows during flood events are expected to increase, potentially causing greater depths and extents of flooding.

[107] Department for Communities and Local Government (2012), *National Planning Policy Framework Technical Guidance*.

13.3.49 When considering the influence that climate change may have on the future baseline, against which the impacts from the Proposed Scheme on flood risk have been evaluated, the assessment has used the recommended precautionary sensitivity ranges of key parameters, as given in Table 5 in the technical guidance to the NPPF. The sensitivity testing undertaken allows for variations in climate change factors included in other national guidance.

13.3.50 Further information on the potential additional impacts of climate change for water resources and flood risk is provided in Sections 7 and 8 of Volume 1 and Table 13 of Volume 5: Appendix CT-009-000.

13.4 Effects arising during construction

Avoidance and mitigation measures

13.4.1 The general approach to mitigation is set out in Volume 1.

13.4.2 The following are examples of avoidance and mitigation measures that will reduce potential adverse effects on surface water and flood risk. Further details are given in Volume 5, Appendix WR-002-011 and WR-003-011.

13.4.3 With regard to surface water, the River Thame and its floodplain will be crossed on viaduct to reduce permanent built footprint within the floodplain. The pier footings have been located outside the main channel of the River Thame, reducing the potential for impact on flows.

- The detailed design of all surface watercourse realignments and crossings will be completed in consultation with the Environment Agency to meet their objectives with respect to hydraulic capacity, flood risk, ecology and hydromorphology. Where culverts are required these will be kept as short as practicable. Where reasonably practicable, the permanent channel realignments will be constructed in advance of other activities associated with the construction of the Proposed Scheme. The design mitigation including consideration of design features aligned with the objectives of the WFD (for example use of soft engineering solutions, aquatic marginal planting and the inclusion of natural forms) will ensure that the channels and structures are sufficiently sized to avoid a permanent impact on flow. The following surface water crossings will be dealt with in this way, as discussed further in Volume 5: Appendix WR-002-011:Stoke Brook and tributaries (Map WR-01-014 SWC-CFA11-01 to 06 and SWC-CFA11-19);
- Sedrup Ditch and tributary (Map WR-01-014 SWC-CFA11-07 and SWC-CFA11-08);
- Hartwell Ditch (Map WR-01-014 SWC-CFA11-09);
- Lower Hartwell Ditch and drain (Map WR-01-014 SWC-CFA11-10, SWC-CFA11-11 and SWC-CFA11-30);
- drain from Coney Hill and Fleet Marston Spinney (Map WR-01-015 SWC-CFA11-15); and

- the drain from Upper and Lower Cranwell farms (Map WR-01-015 SWC-CFA11-16) to the Fleet Marston Brook.

13.4.4 Drainage from the Proposed Scheme has been designed to reduce the rate and volume of run-off in order to prevent an increase in flood risk. Drainage, including drainage from associated access roads and hard standings, will discharge, to sustainable drainage systems (SuDS) balancing ponds, prior to subsequent discharge to watercourses or if necessary to sewer. The SuDS balancing ponds provided in the current design are shown on Maps CT-06-040 to CT-06-047 (Volume 2, CFA11 Map Book) and will be designed where practicable to discharge at existing runoff rates and to accommodate for events up to and including 1 in 100 annual probability (1%), including an allowance for climate change. All discharges to watercourses will be conducted in accordance with appropriate approvals with respect to quality and flow, as appropriate.

13.4.5 A new highway scheme, the A4010 Stoke Mandeville bypass, will be provided and the A418 Oxford Road realigned as part of the Proposed Scheme. Appropriate mitigation will be provided to address the risks to the receiving watercourses for both flow and water quality during the detailed design of the Proposed Scheme using the Design Manual for Roads and Bridges[108] and CIRIA guidance[109] to control the runoff rate and water quality in accordance with the necessary approvals.

13.4.6 With regard to flooding, replacement floodplain storage will mitigate for any minor temporary loss of floodplain storage resulting from the construction works. The replacement floodplain storage areas provided in the current design are shown on Maps CT-06-040 to CT-06-047 (Volume 2, CFA11 Map Book) and will be provided prior to the construction of built structures within the flood plain.

13.4.7 The detailed design of the diversions on the Stoke Brook and tributaries will ensure that there is no reduction in river flow and that adverse impacts on flood risk and on hydromorphology are minimised. More detail is given in the CFA11 FRA (Volume 5: Appendix WR-003-011).

13.4.8 To reduce potential impacts on flood risk, all culverts for watercourses and land drains including the Stoke Brook, Sedrup Ditch and Lower Hartwell Ditches, have been designed to convey at least the 1 in 100 years return period (1% annual probability) flood flow, including an allowance for climate change. This has ensured that flow is not reduced and continues to be conveyed to the downstream catchment, whilst ensuring downstream flood risk is not increased.

13.4.9 The draft CoCP sets out the measures and standards of work that will be applied to the construction of the Proposed Scheme (see Volume 5: Appendix CT-003-000/1). These will provide effective management and control of the impacts during the construction period.

[108] DMRB Volume 4, Section 2.
[109] Murname, E., Heap, A. and Swain, A., (2006), *C648 Control of Water Pollution from Linear Construction Sites*, CIRIA, London, UK.

13.4.10 With regard to surface water, in accordance with the draft CoCP, Section 16, monitoring of the realigned Stoke Brook channels will be undertaken in consultation with the Environment Agency prior to, during and post construction, if required, to establish baseline conditions for surface water and groundwater and to confirm the effectiveness of agreed temporary and permanent mitigation measures. Section 16 of the draft CoCP requires contractors to obtain the necessary consents from the statutory authorities to enable discharge of surface water run-off to the public sewer network or watercourses from construction compounds, such as at the Thame Valley viaduct satellite compound, avoiding an increase in the risk of sewer or watercourse flooding.

13.4.11 With regard to groundwater, vertical migration of poorer quality surface water or poor quality porewater[110] in soils into the superficial aquifers (River Terrace Deposits, Alluvium and Head) will be minimised by selection of piling methods which will provide an appropriate seal in the superficial deposits or surface soil layers. If contamination is encountered this will be remediated before piling is undertaken in that location. Application of measures within the draft CoCP (see section 16) will ensure suitable installation techniques for the foundations are applied. The risk assessment and design measures will be included with the method statement for the temporary works.

13.4.12 With regard to flood risk, in accordance with Section 16 of the draft CoCP, excavated material storage, construction compounds and site offices will be located outside of areas at risk of flooding where reasonably practicable, including the floodplains of the Stoke Brook and River Thame (Map WR-01-015, SWC-CFA11-12 to SWC-CFA11-14, Volume 5, Water Resources and Flood Risk Assessment Map Book), to avoid having an impact on the risk of flooding elsewhere. Where construction compounds cannot be located outside flood risk areas, there will be a site specific flood risk management plan prepared prior to construction to manage the potential risks.

Assessment of impacts and effects

13.4.13 This section describes the significant effects following the implementation of avoidance and mitigation measures.

13.4.14 Further details of the potential impacts that will not have significant effects are provided in the Water Resources Assessment report in Volume 5: Appendix WR-002-011 and Flood Risk Assessment in Appendix WR-003-011.

13.4.15 An assessment of the impact on the WFD status is detailed within the WFD Compliance Assessment, contained within the route-wide Water Resources Appendix (Volume 5: Appendix WR-001-000).

13.4.16 It is considered that projected climate change effects, combined with the effects from the construction of the Proposed Scheme, will not alter the significance of any of the reported effects on surface water and groundwater resources (see Volume 3: Route-wide Effects Assessment for further information).

[110] Porewater is the water within the soil or rock matrix above the water table. It represents a small volume of water that does not drain under gravity as the water is held in place by surface tension or adsorption by other forces onto soil particles.

Temporary effects

Surface water

13.4.17 The assessment shows that there will be no significant temporary adverse effects on surface water resources during the construction period.

Groundwater

13.4.18 The assessment shows that there will be no significant temporary adverse effects on groundwater resources or water dependent habitats during the construction period.

Flood risk

13.4.19 The assessment shows that there will be no significant temporary adverse effects on flood risk from all sources during the construction period.

Cumulative effects

13.4.20 There are no committed developments that have been identified which will result in significant cumulative temporary effects.

Permanent effects

Surface water

13.4.21 The assessment shows that there will be no significant permanent adverse effects on surface water resources.

Groundwater

13.4.22 The assessment shows that there will be no significant permanent adverse effects on groundwater resources or water dependent habitats.

Flood risk

13.4.23 The assessment shows that there will be no significant permanent adverse effects on flood risk.

Cumulative effects

13.4.24 There are no committed developments that have been identified which will result in significant cumulative effects.

Other mitigation measures

13.4.25 No other mitigation measures are envisaged for surface water, groundwater or flood risk.

Summary of likely significant residual effects

13.4.26 No significant adverse residual surface water, groundwater or flood risk effects during construction have been identified within the assessment.

13.5 Effects arising from operation

Avoidance and mitigation measures

13.5.1 Generic examples of design measures that will mitigate impacts so that there will be no significant adverse effects on the quality and flow characteristics of surface water courses and groundwater bodies during operation and management of the Proposed Scheme are described in Volume 1, Section 9 and in the operation and maintenance plan for water resources and flood risk included in Volume 5 Appendix WR-001-000.

13.5.2 Site specific examples of design measures that will mitigate impact include the drainage arrangements for the Proposed Scheme in the study area. This comprises twenty one balancing ponds for either railway or highway drainage. These ponds and their associated access tracks are shown in Maps CT-06-040 to CT-06-047 (Volume 2, CFA11 Map Book).

13.5.3 Generic examples of management measures during operation and management of the Proposed Scheme that will mitigate impacts so that there are no significant adverse effects on the quality and flow characteristics of surface water courses and groundwater bodies are described in Volume 1, Section 9 and in the draft operation and maintenance plan for water resources and flood risk included in Volume 5: Appendix WR-001-000.

13.5.4 As noted in the generic assessment in Volume 3, the risk of pollution from accidental spillage is considered to be extremely low. Incorporation of appropriate spillage control measures within the drainage of the viaduct will reduce this risk further.

13.5.5 Operation and management of the Proposed Scheme is not likely to have a significant adverse effect on flood risk anywhere in the catchments through which it passes. Generic examples of management measures that may mitigate flood risk are described in Volume 1.

Assessment of impacts and effects

13.5.6 There are considered to be no significant effects to surface water, groundwater or flooding arising from operation of the Proposed Scheme.

Other mitigation measures

13.5.7 There are considered to be no further measures required to mitigate adverse effects on surface water resources or groundwater resources or flood risk.

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