

HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement 3 and
Additional Provision 4 Environmental Statement

Volume 2 | Community forum area reports

CFA9 Central Chilterns

October 2015

SES3 and AP4 ES 3.2.1.9



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Department for Transport

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Structure of the HS2 Supplementary Environmental Statement 3 and Additional Provision 4 Environmental Statement

The Supplementary Environmental Statement 3 (SES3) and Additional Provision 4 Environmental Statement (AP4 ES) comprises:

- non-technical summary (NTS). This provides a summary in non-technical language of the SES3 (Part 1) and AP4 ES (Part 2) and of any likely significant environmental effects, both beneficial and adverse, which are new or different to those reported in the High Speed Two (HS2) Phase One Environmental Statement (ES) submitted to Parliament in November 2013 in support of the hybrid Bill ('the Bill') for Phase One of HS2 (hereafter referred to as 'the main ES') as updated by subsequent SES and AP ES documents;
- Volume 1: introduction to the SES3 and AP4 ES. This introduces the supplementary environmental information and design changes included within the SES3 and amendments, which have resulted in the need to amend the Bill, within the AP4 ES. It also explains any changes to the scope, methodology, assumptions and limitations required for the environmental assessment;
- Volume 2: community forum area (CFA) reports and map books. These describe the supplementary environmental information and design changes included within the SES3 (Part 1) and amendments within the AP4 ES (Part 2). Any new or different likely significant environmental effects arising from these changes and amendments in each CFA, compared to those reported in the main ES, as updated by SES and SES2 documents (and SES3 for the AP4 amendments) are reported. The AP1, AP2 and AP3 amendments are also taken into account where relevant. In addition, the main local alternatives that have been considered are described, where relevant;
- Volume 3: route-wide effects. This reports new or different likely significant route-wide effects arising from the supplementary environmental information and design changes included within the SES3 (Part 1) and amendments within the AP4 ES (Part 2) compared to those reported in the main ES as updated by SES and SES2 (and SES3 for the AP4 amendments). The AP1, AP2 and AP3 amendments are also taken into account where relevant;
- Volume 4: off-route effects. This reports new or different likely significant off-route effects arising from the supplementary environmental information and design changes included within the SES3 (Part 1) and amendments within the AP4 ES (Part 2) compared to those reported in the main ES as updated by SES (and SES3 for the AP4 amendments). The AP1, AP2 and AP3 amendments are

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also taken into account where relevant;

- Volume 5: appendices and map books. This contains environmental information and associated maps in support of the other volumes of the SES₃ and AP₄ ES; and
- glossary of terms and list of abbreviations. This contains any new or different terms and abbreviations used throughout the SES and AP ES reports, additional to those included in the main ES.

Structure of this report

This volume of the SES3 and AP4 ES is divided into CFA reports, which are in turn divided into two parts.

Part 1 of this CFA report provides supplementary environmental information relating to:

- new baseline information with respect to ecological surveys conducted during 2015; and
- additional traffic surveys.

Part 1 of each CFA report includes, where relevant:

- a description of the changes or updates within the CFA that have triggered the need for reassessment;
- an assessment of the environmental effects of the changes for relevant environmental topics considering the:
 - scope, assumptions and limitations of the SES3 assessment;
 - changes of relevance to the assessment;
 - environmental baseline;
 - effects arising during construction;
 - effects arising from operation; and
 - mitigation and residual effects; and
- a summary of any new or different likely residual significant effects as a result of the changes.

Part 2 of this CFA report provides environmental assessment information relating to proposed amendments to the design, which have resulted in the need to alter the powers conferred by the Bill. The following is included where relevant:

- a summary of the proposed amendments within each CFA that have triggered the need for reassessment;
- a description of each amendment;
- an assessment of the environmental effects of each amendment for relevant environmental topics considering the:
 - scope, assumptions and limitations of the AP4 ES assessment;
 - environmental baseline;
 - effects arising during construction;
 - effects arising from operation; and
 - mitigation and residual effects; and

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- a summary of any new or different likely residual significant effects as a result of each proposed amendment.

1 Introduction

- 1.1.1 The Bill for high speed rail between London and the West Midlands was submitted to Parliament together with the main ES in November 2013. The AP1 ES, which was submitted in September 2014, contained generally minor amendments to the design of the original scheme (i.e. the scheme submitted in November 2013) in CFAs 7 – 26. The SES and AP2 ES which was submitted in July 2015, updated the main ES and contained a number of further amendments to the design of the original scheme in CFAs 4 – 26. The SES2 and AP3 ES which was submitted in September 2015, contained further updates to the main ES and reported the assessment of a number of amendments to the design of the original scheme in CFAs 1 – 5.
- 1.1.2 Since the submission of the main ES and subsequent SES and AP documents, updates to environmental baseline information and changes to scheme design or assumptions have occurred, which may lead to new or different significant effects. These effects, depending on the type of change, are reported in the SES3 (Part 1) or AP4 ES (Part 2) of this document, where they occur.
- 1.1.3 The Bill and associated Additional Provisions (APs) to the Bill described above, if enacted by Parliament, will provide the powers to construct, operate and maintain Phase One of HS2.
- 1.1.4 In order to differentiate between the original scheme and the subsequent changes, the terms set out in Table 1 are used.

Table 1: Scheme definitions

Scheme name	Definition	Relevant CFAs
the original scheme	the Bill scheme submitted to Parliament in November 2013, which was assessed in the main ES	1 – 26
the AP1 revised scheme	the original scheme as amended by the AP submitted in September 2014	7 – 26
the SES scheme	the original scheme with the design changes described in the SES submitted in July 2015	4 – 26
the AP2 revised scheme	the SES scheme as amended by the AP2 submitted in July 2015	4 – 26
the SES2 scheme	the original scheme as updated by the SES scheme, with the design changes described in the SES2 submitted in September 2015	1 – 5 (i.e. this applies in the London area only)
the AP3 revised scheme	the SES2 scheme as amended by the AP3 submitted in September 2015	1 – 5 (i.e. this applies in the London area only)
the SES3 scheme	the SES2 scheme with the design changes described in the SES3 submitted in October 2015	4 – 26

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Scheme name	Definition	Relevant CFAs
the AP4 revised scheme	the SES3 scheme as amended by the AP4 submitted in October 2015	4 – 26

- 1.1.5 SES3 (Part 1 of this report) contains updated environmental baseline information with respect to ecological and traffic and transport surveys. The changes are described under a series of sub-headings, and assessed on a topic by topic basis using the same approach adopted in the main ES.
- 1.1.6 The purpose of SES3 is to provide an assessment of any new or different likely significant environmental effects arising from the updated baseline information described.
- 1.1.7 There were no SES2 changes in this CFA, so the SES3 changes are compared to the SES scheme. There were AP1 and AP2 amendments, so these are taken into account as appropriate.
- 1.1.8 The AP4 ES (Part 2 of this report) describes the likely significant effects of amendments to the design of the scheme, which require the use of land outside the original limits of the Bill, additional access rights, or other extensions to the powers conferred by the Bill, making it necessary to submit an AP to the Bill. The amendments assessed within the AP4 ES for this CFA include:
- extension of the Chiltern tunnel from Mantle’s Wood portal to South Heath green tunnel north portal and associated works (AP4-009-001); and
 - realignment of diverted Footpath GMI/2 near South Heath (AP4-009-002).
- 1.1.9 The AP4 ES assesses each amendment separately for all relevant topics. The purpose of the AP4 ES is to provide an assessment of any new or different likely significant environmental effects arising from the amendments compared to the SES3 scheme, taking into account AP1 and AP2 amendments where relevant.
- 1.1.10 The standard measures that will be used to mitigate likely significant adverse environmental effects during construction and operation of the scheme are described in the main ES, Volume 1, Section 9 and the draft Code of Construction Practice (CoCP) submitted in support of the Bill. Implementation of these measures has been assumed in this SES3 and AP4 ES.

Part 1: Supplementary Environmental Statement 3

2 Summary of changes

2.1 New environmental baseline information

Ecology

- 2.1.1 Surveys for amphibians undertaken in this area during 2015 are relevant to the assessment.
- 2.1.2 Details of all amphibian surveys undertaken in this area during 2015 are provided in SES3 and AP4 ES, Volume 5: Appendix EC-001-002 and Volume 5 map series EC-04.
- 2.1.3 A summary of supplementary ecological information that is relevant to the SES3 assessment is included within Section 3 under 'Ecology'.

Traffic and transport

- 2.1.4 Additional traffic surveys have been undertaken at junctions in the Central Chilterns area to supplement the information reported in the main ES. The impacts of traffic associated with the construction of HS2 in this CFA have been reassessed in the context of this supplementary data. The assessment of the additional baseline data is reported in Section 3.
- 2.1.5 Details of the survey data are included in SES3 and AP4 ES, Volume 5: Appendix TR-001-000.

2.2 Topics included in the SES3 assessment

- 2.2.1 The changes described above in Section 2.1 result in new or different significant effects in respect of ecology and traffic and transport.

3 Assessment of changes

3.1 Ecology

Introduction

- 3.1.1 This section of the report describes the environmental baseline in relation to ecology that is relevant to the SES3 assessment. It then identifies any new or different likely significant environmental effects as a result of the changes introduced in Section 2, compared to those of the SES scheme.

Scope, assumptions and limitations

- 3.1.2 Updates to the scope of the assessment for ecology are set out in Volume 1 of the SES3 and AP4 ES. The key assumptions and limitations, and the methodology for determining significance of effects are as set out in Volume 1, the Scope and Methodology Report (SMR) and the SMR Addendum (Volume 5: Appendix CT001-000/01 and Appendix CT- 001-000/02 of the main ES) and in Addendum 4 to the SMR (SES 3 and AP4 ES, Volume 5: Appendix CT-001-000/5).
- 3.1.3 To address any limitations in data, a precautionary baseline has been considered according to the guidance reported in the main ES, Volume 5: Appendix CT-001-000/2. This constitutes a 'reasonable worst-case' basis for the subsequent assessment. The precautionary approach to the assessment that has been adopted identifies the likely significant ecological effects of the SES3 scheme.

SES3 changes of relevance to this assessment

- 3.1.4 The only SES3 change relevant to this assessment is the new baseline survey information relating to great crested newt.

Environmental baseline

Existing baseline

- 3.1.5 The ecological baseline for the assessment takes into account baseline information collected in support of the main ES, which included field survey data, aerial photography and relevant existing information gathered from national organisations and from regional and local sources. A full list of data sources that informed the main ES assessment in this area is provided in Volume 2, CFA9, Section 7 of the main ES. The assessment also takes into account additional desk-study and survey information that is reported in Volume 5 of the SES and AP2 ES.
- 3.1.6 Supplementary information relevant to the SES3 assessment in this CFA is limited to additional survey work for great crested newt undertaken in this area during 2015 provided in SES3 and AP4 ES, Volume 5: Appendix EC-001-002 and Volume 5 map series EC-04.
- 3.1.7 A summary of the baseline information relevant to the SES3 assessment is provided below.

Designated sites

- 3.1.8 There has been no change to the baseline information relating to designated sites and ancient woodland which is set out in Volume 2, CFA₉ of the main ES and Part 1 of the SES and AP₂ ES.

Habitats

- 3.1.9 There has been no change to the baseline information relating to habitats which are set out in Volume 2, CFA₉ of the main ES and Part 1 of the SES and AP₂ ES.

Protected and/or notable species

- 3.1.10 The main ES assumes on a precautionary basis that the pond adjacent to the B485 Chesham Road supports a medium sized population of great crested newt of up to county/metropolitan value. Environmental DNA (eDNA¹) survey of this pond in 2015 identified that great crested newts are likely to be absent. Therefore, based on the revised baseline information the pond is now known to be of negligible value for great crested newt.

Future baseline

Construction (2017)

- 3.1.11 Volume 5, Appendix CT-004-000 of the SES₃ and AP₄ ES provides details of the developments which are assumed to have been implemented by 2017, additional to those identified in the main ES and the SES and AP₂ ES.
- 3.1.12 None of the identified developments affect the assessment of the SES₃ scheme's likely construction impacts on ecology.

Operation (2026)

- 3.1.13 Volume 5, Appendix CT-004-000 of the SES₃ and AP₄ ES provides details of the developments which are assumed to have been implemented by 2026, additional to those identified in the main ES and the SES and AP₂ ES.
- 3.1.14 None of the identified developments affect the assessment of the SES₃ scheme's likely operational impacts on ecology.

Effects arising during construction

Avoidance and mitigation measures

- 3.1.15 The assessment assumes implementation of the measures set out within the draft CoCP (Volume 5: Appendix CT-003-000 of the main ES), which includes translocation of protected species where appropriate.

¹ Environmental DNA is that which is released into the water by plants and animals in a host of ways: from their skin, faeces, mucus, hair, eggs and sperm, or when they die. It provides a means to undertake a diagnostic test to determine the presence or likely absence of a specific target species.

Assessment of impacts and effects

Designated sites

- 3.1.16 The new baseline data will not give rise to new or different significant effects on designated sites and will not change the level of significance of the effects reported in the main ES and the SES and AP₂ ES.

Habitats

- 3.1.17 The new baseline data will not give rise to a new or different significant effect on habitats and will not change the level of significance of the effects reported in the main ES and the SES and AP₂ ES.

Protected and/or notable species

- 3.1.18 The main ES reports that the loss of extensive terrestrial habitat could reduce the viability of the potential breeding population of great crested newt in the pond adjacent to the B485 Chesham Road. As part of the precautionary approach, the main ES reports that habitat loss and fragmentation could result in a permanent adverse effect on the conservation status of this population that would be significant at up to the county/metropolitan level.
- 3.1.19 An eDNA survey undertaken in 2015 has identified that great crested newt is likely to be absent from the pond adjacent to the B485 Chesham Road. The new baseline information means that the significant effect on the assumed population reported in the main ES will not occur.

Cumulative effects

- 3.1.20 There are no new or different likely significant cumulative effects for ecology as a result of the SES₃ changes interacting with one another, the AP₁ amendments, the AP₂ amendments or any relevant committed development.

Other mitigation measures

- 3.1.21 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.

Summary of likely residual significant effects

- 3.1.22 The change to the baseline information from updated survey data will not give rise to a new or different likely residual significant effect and will not change the level of significance of the effects reported in the main ES or Part 1 of the SES and AP₂ ES.

Effects arising from operation

- 3.1.23 The new baseline data do not change the operation of the scheme and so there are no new or different significant effects for ecology during operation as a result of the proposed SES₃ changes, in comparison with those described in the main ES and SES and AP₂ ES.

3.2 Traffic and transport

Introduction

- 3.2.1 This section of the report provides a description of the environmental baseline in relation to traffic and transport that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the changes introduced in Section 2, compared to the SES scheme.

Scope, assumptions and limitations

- 3.2.2 The assessment scope, key assumptions and limitations and the methodology for determining significance of effects for traffic and transport are as set out in Volume 1, the SMR and the SMR Addendum (Volume 5: Appendix CT-001-000/1 and CT-001-000/2) of the main ES.

SES3 changes of relevance to this assessment

- 3.2.3 Supplementary traffic data has been collected at the following highway junctions and sections of highway that are the subject of this reassessment.
- A413 Missenden bypass/Weedon Hill;
 - A413/Chalk Lane/Taylor's Lane;
 - A4010 New Road/Cressex Road;
 - A40 West Wycombe Road/A4010 Chapel Lane;
 - A40 West Wycombe Road/A4010 Bradenham Road; and
 - A4010 Wycombe Road, between Princes Risborough and A40 at West Wycombe.
- 3.2.4 Further supplementary traffic data has also been collected at other junctions that are relevant to the AP4 amendment (AP4-009-001) and are addressed in Section 5.
- 3.2.5 Details of all the new survey data are included in SES3 and AP4 ES, Volume 5: Appendix TR-001-000.

Environmental baseline

Existing baseline

- 3.2.6 The existing baseline for traffic and transport is as set out in Volume 2, CFA9, Section 12 of the main ES, updated by the additional traffic surveys.

Future baseline

Construction

- 3.2.7 The future baseline for construction is as set out in Volume 2, CFA9, Section 12 of the main ES, updated by the additional traffic surveys.

Operation (2026 and 2041)

- 3.2.8 The future baselines for operation are as set out in Volume 2, CFA₉, Section 12 of the main ES, updated by the additional traffic surveys.

Effects arising during construction

Avoidance and mitigation measures

- 3.2.9 No avoidance or mitigation measures, additional to those reported in the main ES are proposed.

Assessment of impacts and effects

- 3.2.10 The supplementary traffic surveys have the potential to change the assessment of the impacts of HS₂ construction traffic on the local network, with regard to congestion and delays to vehicle users and to traffic related severance for non-motorised users.

Temporary effects

- 3.2.11 The revised assessment has identified new likely significant effects in relation to congestion and delays to vehicle users at the following junctions:

- A₄₀₁₀ New Road/Cressex Road: a new major adverse significant effect; and
- A₄₀ West Wycombe Road/A₄₀₁₀ Chapel Lane: a new major adverse significant effect.

- 3.2.12 The revised assessment of the A₄₁₃ Missenden bypass/Weedon Hill, A₄₀ West Wycombe Road/A₄₀₁₀ Bradenham Road and A₄₁₃/Chalk Lane/Taylor's Lane junctions has not identified any new or different likely significant effects in comparison to the main ES or the SES and AP₂ ES.

- 3.2.13 The revised assessment has identified a new likely moderate adverse significant effect in relation to traffic related severance for non-motorised users on A₄₀₁₀ Wycombe Road, between Princes Risborough and A₄₀ at West Wycombe (this section of road was not previously assessed).

Permanent effects

- 3.2.14 The permanent effects of construction on traffic and transport are reported under 'Effects arising from operation'.

Other mitigation measures

- 3.2.15 No changes to mitigation measures reported in Volume 2, CFA₉, Section 12 of the main ES are required.

Cumulative effects

- 3.2.16 The above assessment has taken into account cumulative effects, including planned development by taking account of background traffic growth, as well as traffic and transport impacts of works being undertaken in neighbouring areas.

- 3.2.17 There are no new or different likely significant cumulative effects for traffic and transport as a result of the SES₃ changes interacting with AP₂ amendments.

Summary of likely residual effects

- 3.2.18 The supplementary traffic data has identified that there will be new major residual adverse significant effects in relation to congestion and delays at the A4010 New Road with Cressex Road junction and A40 West Wycombe Road with A4010 Chapel Lane junction. There will also be a new moderate adverse residual significant effect at the A4010 Wycombe Road between Princes Risborough and A40 at West Wycombe, in relation to traffic related severance for non-motorised users.
- 3.2.19 The significant effects that result from the supplementary traffic data are shown on map series TR-03 in the SES3 and AP4 ES, Volume 5, Traffic and Transport Map Book.

Effects arising from operation

- 3.2.20 There are no new or different significant operation effects for traffic and transport as a result of the SES3 assessment, in comparison with those described in the main ES and SES and AP2 ES.

Part 2: Additional Provision 4 Environmental Statement

4 Summary of amendments

- 4.1.1 Table 2 provides a summary of the amendments in the Central Chilterns area (CFA9) and Figure 1 shows the locations.
- 4.1.2 Amendments in this CFA result in significant changes to waste arisings, which are reported in Volume 5, Appendix WM-001-000 of the SES3 and AP4 ES.
- 4.1.3 An assessment of the likely significant environmental effects associated with the disposal of construction, demolition, excavation, worker accommodation site and operational waste has been undertaken for the SES3 scheme and AP4 revised scheme as a whole. See Volume 3, Section 19 of the SES3 and AP4 ES for further information.

Table 2: Summary of amendments in CFA9

Name of amendment	Description of the SES3 scheme and AP2 revised scheme	Description of the AP4 revised scheme
<p>Extension of the Chiltern tunnel from Mantle's Wood portal to South Heath green tunnel north portal and associated works (AP4-009-001).</p>	<p>The SES3 scheme provides for the route to emerge from a tunnel at Mantle's Wood and continue north-west mainly in deep cutting, to just before the B485 Chesham Road where it would enter the South Heath green tunnel. Upon emerging from the South Heath green tunnel, north of Frith Hill, the SES3 scheme would continue north-west in a cutting, up to 11m deep in this area, north to Leather Lane.</p> <p>The SES3 scheme provides for the permanent provision of the Chiltern tunnel north portal, located approximately 600m west of Hyde Heath including a portal building, access track and a 100m-long porous portal².</p> <p>In the AP1 revised scheme, changes were made to include an access track from the A413 Aylesbury Road for construction of a balancing pond and maintenance access. The access track crossed the Marylebone to Aylesbury railway, south of No Man's Wood before turning east and continuing parallel to the railway.</p> <p>In the AP2 revised scheme (amendment AP2-009-001) changes were made to extend the Chiltern tunnel north portal to 220m.</p> <p>If the AP4 amendment is enacted the AP1 and AP2 amendments will not be pursued.</p>	<p>Extension of the bored Chiltern tunnel by approximately 2.6km from Mantle's Wood emerging at a revised Chiltern tunnel north portal north-west of South Heath, including a 200m long porous portal.</p> <p>The changes within CFA9 associated with the extension of the Chiltern tunnel are listed below:</p> <ul style="list-style-type: none"> • extension of bored Chiltern tunnel by approximately 2.6km and an increase in depth and width of the bored tunnel alignment; • a deepening of Little Missenden ventilation shaft; • new Chesham Road ventilation shaft and auto-transformer station and associated satellite compound; • a permanent realignment to a 400kV overhead electricity line to the south of the amendment's Chiltern tunnel north portal, west of South Heath; • the Chiltern tunnel north portal construction compound adjacent to portal with temporary access from the A413 Missenden bypass; and • incorporation of landscape earthworks and planting around the new north portal to integrate the feature into the surrounding landform.
<p>Realignment of diverted Footpath GMI/2 near South Heath (AP4-009-002).</p>	<p>Footpath GMI/2 remains open during construction. It will then be permanently diverted 200m to the west over Footpath GMI/2 accommodation overbridge, adding an additional 550m to the Public Right of Way (PRoW).</p>	<p>To avoid Footpath GMI/2 running alongside the route, the footpath will be diverted to run along the outer edge of the landscape planting instead of along the inner edge. This will visually screen the PRoW from the route.</p>

² Porous portals are perforated structures at tunnel portals. These are usually formed of concrete and designed to allow the passage of air from the tunnel. Their function is to reduce the build-up of air pressure when a high-speed train enters a tunnel. The use of this porous portal will ensure that the pressure waves are controlled and kept at a level which does not significantly affect the surrounding area.

Name of amendment	Description of the SES ₃ scheme and AP ₂ revised scheme	Description of the AP ₄ revised scheme
		The footpath diversion will be reduced in length by approximately 20m and is within the land required for construction. This amendment requires a change to bill powers.

5 Assessment of amendments

5.1 Extension of the Chiltern tunnel from Mantle's Wood portal to South Heath green tunnel north portal and associated works (AP4-009-001)

- 5.1.1 The SES3 scheme provides for the route to pass beneath part of the Chilterns Area of Outstanding Natural Beauty (AONB) in tunnel. The SES3 scheme for the Chiltern tunnel provides for a 13.5km twin-bored tunnel commencing south of the M25 between junctions 16 and 17 and east of Chalfont St Peter, in the Colne Valley area (CFA7) and emerging at Mantle's Wood, north-west of Hyde Heath, in the Central Chilterns (CFA9). There are four ventilation and intervention shafts along the length of the Chiltern tunnel, near Chalfont St Peter, Chalfont St Giles, Amersham all in the Chalfonts and Amersham area (CFA8) and near Little Missenden in the Central Chilterns area (CFA9).
- 5.1.2 Upon emerging from the Chiltern tunnel (in CFA9), the SES3 scheme continues north-west in a cutting, up to 23m deep, for approximately 750m, then on an embankment, up to 5m high, for approximately 100m. It then continues in a cutting, up to 13m deep, for approximately 650m up to the B485 Chesham Road, south-west of South Heath. The SES3 scheme enters the South Heath green tunnel adjacent to the B485 Chesham Road and continues north-west, emerging north-west of South Heath and east of Great Missenden. Upon emerging from the South Heath green tunnel, north of Frith Hill, the SES3 scheme continues north-west in a cutting, up to 11m deep in this area, north of Leather Lane continuing through to the Dunsmore, Wendover and Halton area (in CFA10) (see Map CT-05-030 to 034b and CT-06-030 to 034b from the main ES).
- 5.1.3 The SES3 scheme provides for the permanent provision of the Chiltern tunnel north portal, located approximately 600m west of Hyde Heath including a portal building, access track and a 100m long porous portal.
- 5.1.4 In the AP1 revised scheme, changes were made to include an access track from the A413 Aylesbury Road for construction of a balancing pond and maintenance access. The access track crossed the Marylebone to Aylesbury railway, south of No Man's Wood before turning east and continuing parallel to the railway.
- 5.1.5 In the AP2 revised scheme, changes were made to extend the Chiltern tunnel north porous portal to 220m (AP2-009-001). The portal building was relocated approximately 120m north-west along the route to accommodate the longer portal. The permanent access track to the portal building and associated earthwork was extended by approximately 120m in length and realigned closer to the track. All changes associated with the Chiltern tunnel in the AP2 amendment were within the Central Chilterns area (CFA9).
- 5.1.6 The Select Committee published a statement on 21 July 2015 stating that it believed the case had been made for an extension of the bored Chiltern tunnel to the north end of the South Heath green tunnel. Following this statement, the AP4 revised scheme includes provision for an approximately 2.6km extension to the tunnel, from Mantle's Wood, north-west of Hyde Heath, to a revised Chiltern tunnel north portal, north-west

of South Heath (refer to map CT-05-033 and CT-06-033 in the SES3 and AP4 ES, Volume 2, CFA9 Map Book).

5.1.7 If the AP4 amendment is enacted both the AP1 and AP2 amendments will not be pursued.

5.1.8 The AP4 amendment would result in the following changes to impacts within CFA9:

- reduced landscape and visual effects on South Heath and on part of the Chilterns AONB during both construction and operation;
- a reduction in the loss of areas of ancient woodland that would have occurred due to the SES3 scheme;
- land severance impacts on agriculture and habitat will be reduced;
- a reduction in the number of demolitions required;
- an overall reduction in traffic and transport impacts;
- amenity effects will no longer arise due to lower noise levels, both during construction and operation; and
- impacts reduced through avoidance of footpath closures or diversion.

5.1.9 This amendment includes changes to the scheme design in the Chalfonts and Amersham; Central Chilterns; and Dunsmore, Wendover and Halton areas (i.e. CFA8, CFA9 and CFA10), as well as changes in the Colne Valley area (CFA7) in relation to traffic. These are described in the relevant SES3 and AP4 ES, CFA reports. In addition to the 2.6km tunnel extension, the amendment (AP4-009-001) will incorporate the following, from south to north in CFA8, CFA9 and CFA10:

- the same horizontal alignment as the SES3 scheme (CFA8, CFA9 and CFA10);
- the addition of cooling equipment and accompanying electrical switchgear to ventilation shafts at the following locations along the route: Chalfont St Peter, Chalfont St Giles and Amersham in CFA8 and Little Missenden and Chesham Road in CFA9. No additional land is required to accommodate this equipment;
- a larger permanent surface area for the Chalfont St Giles ventilation shaft and auto-transformer feeder station to accommodate an express feeder auto-transformer station (CFA8);
- a deepening of the ventilation shaft at the Little Missenden ventilation shaft and auto-transformer feeder station (CFA9);
- a new ventilation shaft located adjacent to Annie Bailey's public house and restaurant with access from the B485 Chesham Road (CFA9);
- environmental mitigation in the SES3 scheme will no longer be required between Mantle's Wood and the new north portal as the scheme will be in a tunnel below the woodland (CFA9);
- a 200m porous portal at the new Chiltern tunnel north portal (CFA9);

- a realignment of a 400kV overhead electricity line to the west of South Heath (CFA9) which includes the replacement of two pylons with one taller pylon;
- a wider and deeper cutting northwards from the new north portal, compared to the SES3 scheme, due to the greater depth of the bored tunnel alignment and a greater width required by the track separation for the bored tunnel. The changes to the cutting will require the height of the overbridges to be increased (in CFA9 and CFA10);
- a Chiltern tunnel north portal construction compound, including a rail fit-out compound, which will be accessed via the A413 Missenden Bypass. This area will be restored to its former use following the rail fit-out stage with permanent access provided from Frith Hill to the new portal (CFA9);
- the provision of noise fence barriers approximately 3m high and 1.4km long at the top of the cutting on the eastern side of the route, extending from the new portal to Leather Lane (in CFA9). The barriers will be integrated with the landscape earthworks and landscape mitigation planting. An alternative 6m high barrier at the bottom of the cutting may also provide the level of attenuation required and could be substituted for the 3m barrier now proposed but further design development is required before this can be confirmed; and
- a midpoint auto-transformer feeder station located on the eastern side of the route north of Leather Lane with access from Leather Lane (in CFA10).

5.1.10 This amendment will result in an overall net reduction in the land required across CFA8, CFA9 and CFA10. In particular, the removal of approximately 9ha (compared to the SES3 scheme) of ancient woodland from Mantle's Wood, Farthings Wood and Sibley's Coppice in CFA9 is no longer required. The elements of the amendment within CFA9 are described in detail in the following sections.

Extension to the Chiltern tunnel

5.1.11 The SES3 scheme provided for circular twin-bore tunnels, each bore with an internal diameter of approximately 8.8m and an external diameter of approximately 9.6m. Depending on surface topography the tunnel depths varied between approximately 15m and 45m below ground level.

5.1.12 Since submission of the SES and AP2 ES, a revised design to the Chiltern tunnel has been developed extending it by approximately 2.6km, emerging to the north-west of South Heath. The AP4 revised scheme will have a lower vertical alignment between Little Missenden and south of Liberty Lane. The difference in vertical alignment between the AP4 revised scheme and SES3 scheme will be up to 32m through this section. The horizontal alignment of the Chiltern tunnel remains unchanged from the SES3 scheme and the line speed will remain at 320kph through the tunnel section.

5.1.13 The amendment surfaces north-west of South Heath. This will require a deeper and wider cutting compared with the SES3 scheme due to the requirement for greater track separation associated with the twin-bore tunnel.

- 5.1.14 The amendment will no longer require the following surface elements between Mantle's Wood and north-west of South Heath all of which are within CFA9:
- the environmental mitigation between Mantle's Wood and Frith Hill provided for within the SES3 scheme. There will also no longer be a requirement for culverts, land drainage and balancing ponds between these two points;
 - noise fence barriers approximately 2m high and 350m long at the base of the cutting from Footpath GMI/27 to 100m north of Hyde Lane overbridge;
 - the Chiltern tunnel north portal located at Hyde Heath, including a porous portal, portal building, midpoint auto-transformer feeder station, 500m² hardstanding and an access road connecting the tunnel portal to Hyde Heath Road;
 - the temporary closures to Hyde Lane, Frith Hill and the permanent realignment of the B485 Chesham Road, King's Lane and Frith Hill;
 - the provision of the GMI/27 accommodation overbridge and permanent diversions to the Footpaths LMI/17, LMI/21, GMI/23, GMI/28, GMI/79 and GMI/80; and
 - the construction of the South Heath green tunnel from the north of the B485 Chesham Road, north-west, emerging north-west of South Heath and east of Great Missenden.

5.1.15 The amendment will avoid demolitions at the following 14 properties:

Table 3: Demolitions avoided due to the AP4 amendment

Description	Location
Residential property (Rowen Farm and four associated outbuildings)	Hyde Lane
Residential property (Hedgemoor and one associated outbuilding)	Hyde Lane
Two residential outbuildings associated with Sheepcotts Cottage	Hyde Lane
Two residential outbuildings associated with Chapel Farm	Hyde Lane
Residential property (Meadowleigh)	Chesham Road
One property (two buildings) with commercial and residential use (Annie Bailey's public house and restaurant)	Chesham Road
Residential property and four associated outbuildings (94 King's Lane and one outbuilding on an adjacent plot)	King's Lane
Residential property (Wenash, 90 King's Lane)	King's Lane

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Description	Location
Two outbuildings associated with one residential property (86 King's Lane)	King's Lane
Commercial property (Elwis Field Farm)	West of Sibley's Coppice
Commercial property (The workshop, Elwis Field Farm)	West of Sibley's Coppice
Commercial property (Weights and Measures Gym)	Frith Hill
Outbuilding associated with a residential property (Orchard Cottage)	Frith Hill
Residential property and associated outbuilding (Chiltern Cottage)	Frith Hill

- 5.1.16 The amendment requires a wider and deeper portal at the northern end of the Chiltern tunnel and will accommodate sufficient space for the extraction of tunnel boring machines (TBMs) and an area of hardstanding, approximately 550m², allowing for the maintenance and emergency access and egress from the tunnel and associated portal buildings and substations. The length of the porous portal for the revised Chiltern tunnel north portal is approximately 200m in length. Planting and landscape earthworks will provide mitigation to integrate the revised north portal into the landscape and to provide visual screening for residents of South Heath, Frith Hill and other dispersed properties including Bury Farm on Potter Row.
- 5.1.17 A new temporary construction access road will be required from the A413 Missenden bypass/A4128 Link Road roundabout east of Great Missenden to connect to the new Chiltern tunnel north portal. A new arm will be provided off the existing roundabout, passing to the north of Stockings Wood (to avoid an area of ancient woodland) before curving back towards South Heath to the revised Chiltern tunnel north portal. This temporary access road will provide access to the Chiltern tunnel north portal satellite and rail installation compounds and to remove dismantled TBMs.
- 5.1.18 The temporary access road will also provide construction access to Leather Lane overbridge satellite compound and Bowood Lane overbridge satellite compound. This will remove construction traffic along Potter Row and King's Lane and relieve traffic on the B485 Chesham Lane. Additionally, Frith Hill, closed in the SES3 scheme during construction, will remain open during construction and will not carry construction traffic. The temporary access road will also be used for approximately 50% of construction traffic trips related to the movement of excavated material temporarily stored at Hunts Green Farm (previously all using Rocky Lane). The remainder of this construction traffic will continue to use Rocky Lane.
- 5.1.19 After completion of the works, the land over which the temporary access road traverses will be restored to its former use, except for the proposed landscape mitigation planting adjacent to Stockings Wood (see map CT-06-033 in the SES3 and AP4 ES).

- 5.1.20 A new access road from Frith Hill will provide permanent access to the revised Chiltern tunnel north portal for maintenance and emergency access to the tunnel portal building during operation. This road will also provide access for Bury Farm to fields to the west of the route.
- 5.1.21 Only two PRoW diversions will be required for the AP4 amendment: GMI/13 (specifically GMI/13/3) and GMI/33 (specifically GMI/33/4). All remaining temporary and permanent PRoW diversions between Mantle's Wood and Frith Hill as set out in the SES3 scheme will no longer be required.
- 5.1.22 The AP4 amendment includes changes to the shape of a balancing pond west of the SES3 scheme and an associated realigned drainage channel running from the railway to the pond located adjacent to the A413 Missenden bypass.
- 5.1.23 The amendment will include reshaping of landscape mitigation earthworks north of the Chiltern tunnel north portal due to the widening of the cutting and an increase in height of overbridges. The amendment will include landscape mitigation planting to provide further screening of the Chiltern tunnel north portal from the west. Landscape mitigation planting will also be included to provide habitat connectivity between the two parcels of ancient woodland of Stocking's Wood following the restoration of land used for the construction access road.
- 5.1.24 The vertical alignment of Footpath GMI/2 accommodation overbridge will alter as a result of a larger span over a wider cutting. The overbridge will be raised by approximately 0.5m.
- 5.1.25 The amendment includes the provision for noise fence barriers approximately 3m high at the top of the cutting on the eastern side of the route, extending from the new portal to Leather Lane, within the Central Chilterns area (CFA9) boundary. The barriers will be integrated with the landscape earthworks and landscape planting. An alternative 6m high barrier at the bottom of the cutting may also provide the level of attenuation required and could be substituted for the 3m barrier now proposed, but further design development is required before this can be confirmed. These noise fence barriers extend the length of barriers proposed by the SES3 scheme by approximately 750m.
- 5.1.26 This amendment has reduced the total permanent area of land required at surface level in CFA9 by approximately 43ha compared to the SES3 scheme.
- 5.1.27 The amendment is shown in maps CT-05-031, CT-05-032, CT-06-031 and CT-06-032 in the SES3 and AP4 ES, Volume 2, CFA9 Map Book.

Little Missenden ventilation shaft and auto-transformer station

- 5.1.28 West of Little Missenden, the SES3 scheme provides for the Little Missenden ventilation shaft, required to provide pressure relief from the tunnels and a dedicated intervention point and access for emergency services. This ventilation shaft would be located south of Keeper's Lane (see map CT-06-030b in the main ES, Volume 2, CFA9 Map Book). Associated with this ventilation shaft is an auto-transformer station, required to transmit both traction power supply and electrical power required for other purposes, including lighting and the operation of equipment in tunnels and shafts. The ventilation shaft will also require tunnel cooling equipment (chillers) and

accompanying electrical switchgear to accommodate an extension to the Chiltern tunnel.

- 5.1.29 The SES3 scheme provides for landscape earthworks curving along the access road and the northern side of the ventilation shaft compound to integrate it into the landscape. Additionally, tree planting along the northern, western and southern boundary of the ventilation shaft compound would screen views from the residents of Little Missenden and integrate the structure into the surrounding landscape.
- 5.1.30 The amendment will lower the vertical alignment and in doing so will deepen this ventilation shaft by approximately 3m. Tree planting along the boundary of the ventilation shaft compound will be provided, as reported in the main ES.
- 5.1.31 The amendment at this location will not alter the total temporary or permanent area of land required in this area compared to the SES3 scheme.

Chesham Road ventilation shaft and auto-transformer station

- 5.1.32 The amendment will require one new ventilation shaft to provide pressure relief from the tunnels and a dedicated intervention point and access for emergency services. This ventilation shaft will be located south of the B485 Chesham Road, adjacent to Annie Bailey's public house and restaurant (see maps CT-05-032 and CT-06-032 in the SES3 and AP4 ES, Volume 2, CFA9 Map Book). Associated with this ventilation shaft is an auto-transformer feeder station, required to transmit both traction power supply and electrical power required for other purposes including lighting and the operation of equipment in tunnels and shafts. The ventilation shaft will require tunnel cooling equipment (chillers) and accompanying electrical switchgear to accommodate an extension to the Chiltern tunnel. Permanent access to this ventilation shaft will be from the B485 Chesham Road. Landscape earthworks and landscape mitigation planting will provide mitigation to screen views and integrate this structure into the landscape.
- 5.1.33 During construction, groundwater from dewatering at the Chesham Road ventilation shaft will be discharged back into the ground via recharge wells in the vicinity of the ventilation shaft (as per other ventilation shafts). The amendment at this location will reduce the total area of land required both temporarily and permanently compared to the SES3 scheme.

Chesham Road ventilation shaft satellite compound

- 5.1.34 The Chesham Road ventilation shaft satellite compound will be used for civil engineering and railway installation works for the Chesham Road ventilation shaft and auto-transformer station. The construction 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 2019, followed by a two month period of inactivity before the railway installation works, which will last for approximately two years commencing in 2023;
 - be approximately 1ha in size;
 - support approximately 30 workers each day throughout much of the civil engineering works period, increasing to a maximum of approximately 65

workers each day during the peak period of activity; the construction compound will also support approximately 20 workers each day throughout much of the rail systems installations works period, increasing to a maximum of approximately 45 workers during the peak period of activity;

- not provide overnight worker accommodation;
- be accessed via the B485 Chesham Road, A413, A40 and M40 from the east; and the A413, A355, A40 and/or B4009, A4010 and M40 and/or B4009, A4129, A418 and M40 from the west;
- have an associated roadhead with access to/from the B485 Chesham Road for the transfer of earthworks material; and
- be managed from the Chiltern tunnel main compound located in the Colne Valley area (CFA7) for the civil engineering works and from the Chilterns main compound (rail systems) for the railway systems installation works.

5.1.35 The works associated with the Chesham Road ventilation shaft will be carried out in the following broad phases:

- site clearance and enabling works;
- install dewatering system;
- set-up diaphragm wall plant;
- install diaphragm walls;
- excavate shaft and install propping;
- construct shaft base and walls;
- tunnel breakthrough to form connection with ventilation shaft;
- internal reinforced concrete fit-out;
- construction of headhouses;
- installation of tunnel cooling equipment;
- rail systems installation; and
- landscaping and planting around the ventilation shaft compounds.

5.1.36 The compound will be used to manage construction of the Chesham Road ventilation shaft and auto-transformer station, which will take approximately two years to construct. Volume 1, Section 5.7 of the main ES provides a description of a typical ventilation shaft and Volume 1, Section 6.14 of the main ES describes the activities associated with ventilation shaft construction.

5.1.37 No road or watercourse realignments or demolitions are required for the works associated with this compound.

5.1.38 Temporary realignment of one PRoW will be required. GMI/33/4 will be temporarily diverted west along a field boundary to join Footpath GMI/33/5 and GMI/33/3, for

approximately 18 months, adding an additional 600m in length. It will then be permanently reinstated along its existing alignment.

5.1.39 There are no diversions of existing utilities but the installation of new utilities will be required. The main installation being a permanent 33kV supply, routed through the Chiltern tunnel from the Ickenham auto-transformer feeder station in CFA7.

5.1.40 Key railway systems installation works associated with the Chesham Road ventilation shaft will be:

- installation of ventilation shaft equipment and commissioning; and
- installation of an auto-transformer station.

5.1.41 Volume 1, Section 5.17 of the main ES provides a generic description of power supply features including auto-transformer stations and Volume 1, Section 6.23 of the main ES contains a description of associated construction activities.

Chiltern tunnel north portal satellite compound (civil engineering and rail systems)

5.1.42 This compound, located adjacent to the new Chiltern tunnel north portal, north-west of South Heath (refer to SES3 and AP4 ES map CT-05-033) will be used for civil engineering works and rail systems installation, between the Chiltern tunnel north portal and South Heath cutting. The construction compound will be approximately 1.5ha in size and will:

- be operational for approximately eight years. During this period there will be civil engineering works for approximately five years, starting in 2017, followed by an approximately one year period of inactivity before the railway installation works, which will last for approximately two years commencing in 2023;
- support approximately 40 workers each day throughout much of the civil engineering works period, increasing to a maximum of approximately 70 workers each day during the peak period of activity;
- not provide overnight worker accommodation;
- be accessed via the temporary access road from the A413/A4128 Link Road roundabout at Great Missenden, A413 and then A40 and M40 and/or A355, A40 and M40; and
- be managed from the Chiltern tunnel main construction compound (see Volume 2, CFA7, Section 2.3 of the main ES) for the civil engineering works.

5.1.43 Works in this section of the AP4 revised scheme will be carried out in the following broad phases:

- site clearance and enabling works;
- demolition;
- culverts and drainage;

- construction of tunnel portal;
- TBM removal;
- cuttings, embankments, landscape earthworks and planting; and
- permanent fencing.

5.1.44 The compound will be used to manage construction of the Chiltern tunnel north portal and South Heath cutting which will take approximately five years.

5.1.45 Key railway systems installation works in this section of the AP₄ revised scheme will take approximately two years to complete and will include:

- fit-out of Chiltern tunnel north portal buildings;
- fit-out of tunnel and railway systems within the Chiltern tunnel; and
- support the testing and commissioning stages.

5.1.46 Volume 1 of the main ES, Section 5.6, provides a description of a typical tunnel portal and Section 5.2 provides a description of a cutting. Volume 1, Sections 6.13 and 6.8 describe the activities associated with their construction, respectively.

5.1.47 Demolitions will be required at one property and for two structures:

- one residential building and five associated outbuildings at one property (Mulberry Park Hill, located off Potter Row)³; and
- two pylon structures at Frith Hill.

5.1.48 No road realignments will be required as a result of these works.

5.1.49 Realignment of one PRoW will be required. Footpath GMI/13 will be temporarily diverted parallel to the A₄₁₃ to join Footpath GMI/12 to cross the route then temporarily diverted south around the edge of the AP₄ revised scheme boundary and to the west of Jenkin's Wood where it will rejoin its existing alignment through the wood. The diversion will last for approximately five years and will be 690m longer than the existing footpath. This footpath will be permanently diverted to the south of the Chiltern tunnel north portal, before rejoining its existing alignment through Jenkin's Wood, adding 490m to the existing footpath.

5.1.50 Diversion of utilities and the installation of new utilities will be required, the key one in this area being the diversion to an existing permanent 400kV overhead electricity line to the west of the new Chiltern tunnel north portal.

5.1.51 No watercourse diversions will be required with works associated with these compounds.

Chiltern tunnel north portal access road satellite compound (adjacent to the A₄₁₃)

5.1.52 The amendment requires a construction compound adjacent to the A₄₁₃, to the west of Great Missenden, to be used for the construction of the temporary access road to

³ This is one additional outbuilding demolition when compared to that reported in the main ES.

the Chiltern tunnel north portal (see map CT-05-033 in the SES3 and AP4 ES, CFA9 Map Book). The construction compound will be approximately 0.5ha and will:

- be in place for 9 months. On completion of the temporary access road this satellite compound will be removed and the land will be restored to its former use, except for the proposed landscape mitigation planting adjacent to Stockings Wood (see map CT-06-033 in the SES3 and AP4 ES, CFA9 Map Book);
- support approximately 20 workers each day throughout much of the civil engineering works period;
- it will be accessed from the A413, A40 and M40 from the east; and the A413, A355, A40 and M40 and/or A413, B4009, A4010 and M40 and/or A413, B4009, A4010, A4129, A418 and M40 from the west; and
- be managed from the Chiltern tunnel main construction compound (see Volume 2, CFA7, Section 2.3.55 of the main ES) for the civil engineering works.

5.1.53 The temporary access road will also provide access to Leather Lane overbridge satellite compound and Bowood Lane overbridge satellite compound. This removes construction traffic along Potter Row and King's Lane and relieves traffic on the B485 Chesham Road.

Changes to local construction programme

5.1.54 The additional tunnel boring works required for the amendment (AP4-009-001) are estimated to take up to ten months longer than the SES3 scheme. However, use of the new Chiltern tunnel north portal satellite compound for rail systems fit-out will enable the rail systems to be installed from both north and south portals. The time taken for that fit-out will be shortened, enabling the overall construction programme reported in the main ES to be maintained.

Main local alternatives

5.1.55 The main strategic alternatives to the SES3 scheme are presented in the main ES, Volume 1. The main local alternatives reported in the main ES are considered further in this section.

Extended Chiltern tunnel north of South Heath

5.1.56 An option for an extension to the Chiltern tunnel was received through the draft ES consultation responses from the Residents' Environmental Protection Association (REPA). This proposed an extension of the Chiltern twin-bore tunnel past South Heath from Mantle's Wood to north of Liberty Lane, adjacent to Leather Lane, requiring an extension in twin-bore tunnel length of approximately 3.6km. This was subject to further assessment and was reported in the main ES with Option A as the original scheme and Option B as the extended tunnel. Despite Option B having environmental benefits, Option A was adopted because of increased cost and the impact of an extended construction period.

- 5.1.57 Since the main ES, further assessment was undertaken of two additional options which were compared to Option A as follows:
- Option A: The original scheme (as deposited in November 2013), with the tunnel portal at Mantle’s Wood;
 - Option C6: A 2.6km extension of the twin-bore tunnel to the location of the original scheme’s South Heath green tunnel north portal, just north of Frith Hill; and
 - Option C5⁴: The REPA proposal for a 4.1km extension of the twin-bore tunnel past South Heath to Leather Lane with an additional tunnel ventilation shaft included near the B485 Chesham Road (referred to as Option B in the main ES (Volume 2, CFA9, Section 2)).
- 5.1.58 Within Options C6 and C5, further options were evaluated with varying construction methods considering programme, cost and environmental impacts. For comparison, Options C6 and C5 assume that all tunnel excavated material would continue to be removed at the southern portal.
- 5.1.59 Options C6 and C5 would perform better on environmental grounds compared with Option A as both would avoid a range of impacts upon environmental receptors due to reduced surface impacts.
- 5.1.60 Options C6 and C5 reduce the landscape and visual effects on South Heath and part of the AONB and reduce ecological impacts. In particular, a number of areas of ancient woodland would be avoided including Mantle’s Wood, Farthings Wood and Sibley’s Coppice. In addition, some land severance impacts on agriculture and habitat would be reduced under Options C6 and C5 compared with Option A.
- 5.1.61 Options C6 and C5 also reduce community impacts upon Frith Hill and South Heath including the avoidance of a number of demolitions to property and community assets. Impacts to heritage and archaeological assets would be avoided or ameliorated due to an extended tunnel section.
- 5.1.62 However, there would be some new local impacts under Options C6 and C5 due to the need to construct an additional ventilation shaft by the B485 Chesham Road, a new temporary access from the A413 to the revised Chiltern tunnel north portal for removal of the TBMs, and the increased width and cutting depth and associated land required to the north of South Heath (or Liberty Lane in the case of Option C5) arising from the lower alignment of the route as it exits from the twin-bore tunnel portal. Additional surplus tunnel excavated material would need to be handled at the tunnel southern portal in CFA7, requiring off-site removal.
- 5.1.63 Option C5 extends the tunnel by an additional 1.5km compared with Option C6, exiting from the twin-bore tunnel portal at Leather Lane. Compared to Option C5, it would have limited additional environmental benefits: some reduction in impacts on the AONB and the number of affected holdings, reduced severance of agricultural land, one fewer demolition, and localised reduction on noise impacts and to the amenity of a number of properties on Potter Row.

⁴ Following the submission of the main ES, REPA changed their proposal for the Chiltern tunnel extension to extend the tunnel to Leather Lane.

- 5.1.64 However, an additional length of tunnel would require a wider cutting further north with Leather Lane realigned around the back of a portal north of Leather Lane. The positioning of the portal and wider cutting would have greater adverse impacts on the setting and character of a number of listed buildings, namely Woodlands Park, Cottage Farm and Hammondshall Farm. Option C5 would result in a shortfall of engineering fill north of South Heath up to the Small Dean viaduct requiring material to be imported for use in the scheme and consequential additional lorry movements. The additional length of tunnel would also generate more excavated material arising at the tunnel southern portal in the Colne Valley area (CFA7) than Option C6, requiring further off-site removal and more lorry movements in CFA7.
- 5.1.65 While the extended tunnel option is feasible in engineering terms and would have environmental benefits, there would be a significant additional cost in extending either of the bored tunnel options. This remains the case even when accounting for savings in engineered structures which would no longer be required. The additional cost involved in implementing Option C5 over Option C6 is considered to be disproportionate to the environmental benefits to be gained.

Topics included in the assessment

- 5.1.66 Those elements of the extension to the Chiltern tunnel from Mantle's Wood portal to South Heath green tunnel north portal which are located within the Central Chilterns area (CFA9) are not considered to make changes that require a reassessment of the environmental effects or proposed mitigation as set out in the main ES with respect to air quality and land quality. However, there were changes where reassessment was considered to be required in respect of: agriculture, forestry and soils, community, cultural heritage, ecology, landscape and visual assessment, socio-economics, sound, noise and vibration, traffic and transport, and water resources and flood risk assessment.

Agriculture, forestry and soils

Introduction

- 5.1.67 This section of the report describes the environmental baseline in relation to agriculture, forestry and soils that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the amendment, compared to those of the SES3 scheme.

Scope, assumptions and limitations

- 5.1.68 The assessment scope, key assumptions and limitations for agriculture, forestry and soils are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001 -000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2).
- 5.1.69 An area of 0.25ha of Sibley's Coppice is shown as falling within the land required for construction of the amendment (map reference CT-05-033 in the SES3 and AP4 ES, CFA9 Map Book). However, no works will be undertaken within this area in order to avoid any impacts on the ancient woodland present.

Existing baseline

- 5.1.70 The majority of the soils which would be affected by the amendment are of the moderately-to-imperfectly drained Batcombe association. Developed over the Clay-with-Flints Formation, these soils consist typically of slightly stony silt loam or silty clay loam topsoils which overlie slightly stony clay loam and clay subsoils and are susceptible to slight seasonal waterlogging; they are within Wetness Class⁵ (WC) II or III. Soils within the Charity 2 association would also be affected; these have slightly or moderately stony silty clay loam topsoils over chalky drift and are within WC I.
- 5.1.71 The principal limiting factor determining agricultural land quality in this area is soil workability with the majority of the land limited to Subgrade 3a and 3b; the well-drained Charity 2 soils are classified as Subgrade 3a due to a droughtiness limitation. Land classified as Subgrade 3a is within the best and most versatile (BMV) agricultural land grade.
- 5.1.72 Twenty-two holdings were identified that would be affected by the SES3 scheme in this CFA, and are shown in Table 4.

Table 4: Holdings affected by the SES3 scheme

Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA09/1 Cokes Bottom Farm	Arable	97	None	None	Medium
CFA09/2 Mantle's Farm	Arable (let) and woodland	114	None	None	Medium
CFA09/3 * Hyde Farm	Grazing (let)	32	None	None	Low
CFA09/4 Field Acres Farm	Arable	930	None	None	Medium
CFA09/5 Middle Grove Farm	Sheep, arable and equestrian	183	Equestrian and buildings let.	Entry level stewardship	Medium
CFA09/6 * Bury Farm	Grazing (let)	35	None	None	Low
CFA09/7 Mulberry Park Hill	Grazing (let)	11	None	None	Low

⁵ The Wetness Class (WC) of a soil is classified according to the depth and duration of waterlogging in the soil profile and has six bands.

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Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA09/8 Springfield Farm	Grazing (let)	24	None	None	Low
CFA09/9 Hammonds Hall Farm	Grazing	4	Cottage let	None	Low
CFA09/10 Park Farm	Grazing	28	None	None	Medium
CFA09/12 * Elwis Field Farm	Grazing	5	None	None	Low
CFA09/13 * Unnamed paddock	Grazing	4	None	None	Low
CFA09/15 * Farthings Wood	Woodland	5	None	None	Low
CFA09/16 * 94 King's Lane	Residential with grazing	1	None	None	Low
CFA09/17 * part of which is Sibley's Coppice	Woodland	6	None	None	Low
CFA09/18 * part of which is Sibley's Coppice	Woodland	2	None	None	Low
CFA09/19 * Gates Farm	Grazing	5	None	None	Medium
CFA09/20 * Unnamed paddock	Residential with grazing	3	None	None	Low
CFA09/21 * Orchard Cottage	Residential with grazing	1	None	None	Low

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Holding reference/name	Holding type	Holding size (ha)	Diversification	Agri-environment	Sensitivity to change
CFA _{09/22} * Frith Hill Farm	Residential with grazing	2	None	None	Low
CFA _{09/23} Cottage Farm	Grazing	17	None	None	Medium
Unidentified holding ⁶	Woodland	20	Shooting club	None	Medium

* No Farm Impact Assessment interview conducted; data estimated.

Future baseline

Construction (2017)

- 5.1.73 Volume 5, Appendix CT-004-000 of the SES₃ and AP₄ ES provides details of the developments that are assumed to have been implemented by 2017, additional to those identified in the main ES (Volume 2, CFA 9, Section 3.3) and the SES and AP₂ ES.
- 5.1.74 None of the identified developments affect the assessment of the amendment's likely construction impacts on agriculture, forestry and soils.
- 5.1.75 Most existing environmental stewardship agreements will expire in 2015 and will be replaced by a new environmental land management scheme (countryside stewardship) which, together with the new greening measures introduced by Common Agricultural Policy reform, will affect the detailed management of individual farm holdings. These are not expected to change fundamentally the baseline circumstances described.

Operation (2026)

- 5.1.76 Volume 5, Appendix CT-004-000 of the SES₃ and AP₄ ES provides details of the developments that are assumed to have been implemented by 2026, additional to those identified in the main ES (Volume 2, CFA 9, Section 3.3) and the SES and AP₂ ES.
- 5.1.77 None of the identified developments affect the assessment of the AP₄ revised scheme's likely operational impacts on agriculture, forestry and soils.

Effects arising during construction

- 5.1.78 The SES₃ scheme required some 170.3ha of agricultural land during construction in CFA₉ of which 144.6 is BMV. Following construction, 71.9ha (including 65.8ha BMV) would be restored to its former use leaving the total area of BMV agricultural land permanently removed as 78.8ha.

⁶ Holding affected by the AP₁-009-002 amendment "Additional land required for construction and maintenance access near No Man's Wood".

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- 5.1.79 As a result of this amendment, 79.8ha of BMV agricultural land will be required in CFA9 during construction of which 35.7ha would be restored, leaving the total area of BMV agricultural land permanently removed as 44.1ha.
- 5.1.80 The 44.1ha still represents more than 60% of the overall agricultural land requirement and as BMV land is a receptor of moderate sensitivity in this study area, the permanent effect on BMV land remains assessed as a major/moderate adverse effect as a result of the AP4 amendment, which is significant.
- 5.1.81 As the amendment requires approximately 45% less BMV agricultural land than the SES3 scheme, the amendment does give rise to a different effect due to the reduction in amount of BMV land required. However, this does not change the level of significance of the effects reported in the main ES.
- 5.1.82 In terms of the effects on holdings, the amendment would alter the effect of the scheme on a number of holdings, shown in Table 5.

Table 5: Holdings which would have an altered effect due to the amendment

Holding reference/name	Area required for SES3 scheme	Assessment of adverse effect (as described in the main ES)	Area required for AP4 revised scheme	Assessment of effect (AP4 revised scheme)
CFA09/1 Cokes Bottom Farm	Temporary 4.7ha Permanent 3.0ha	Minor Negligible	Effects remains the same as reported in the main ES	
CFA09/2 Mantle's Farm	Temporary 43.6ha Permanent 34.7ha	Major/moderate Major/moderate	No longer affected	
CFA09/3 Hyde Farm	Temporary 13.3ha Permanent 8.3ha	Moderate Moderate	No longer affected	
CFA09/4 Field Acres Farm	Temporary 10.8ha Permanent 1.7ha	Negligible Negligible	No longer affected	
CFA09/5 Middle Grove Farm	Temporary 42ha Permanent 22.6ha	Major/moderate Major/moderate ⁷	Temporary 6.8ha Permanent 1.3ha	Negligible Negligible
CFA09/6 Bury Farm	Temporary 18.5ha Permanent 12.1ha	Moderate Moderate	Temporary 24.0ha Permanent 18.2ha	Moderate Moderate
CFA09/7 Mulberry Park Hill	Temporary 11.1ha Permanent 10.2ha	Moderate Moderate ⁷	Effects remains the same as reported in the main ES including property demolition	

⁷ Includes residential demolition

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Holding reference/name	Area required for SES ₃ scheme	Assessment of adverse effect (as described in the main ES)	Area required for AP ₄ revised scheme	Assessment of effect (AP ₄ revised scheme)
CFA _{09/8} Springfield Farm	Temporary 5.9ha Permanent 3.6ha	Moderate Minor	Effects remains the same as reported in the main ES	
CFA _{09/9} Hammonds Hall Farm	Temporary 1.5ha Permanent 0.3ha	Moderate Negligible	Temporary 1.5ha Permanent 0.6ha	Moderate Minor
CFA _{09/10} Park Farm	Temporary 2.1ha Permanent 2.1ha	Minor Minor	Effects remains the same as reported in the main ES	
CFA _{09/12} Elwis Field Farm	Temporary 5.2ha Permanent 2.2ha	Moderate Moderate ⁸	No longer affected	
CFA _{09/13} Unnamed paddock	Temporary 2.4ha Permanent 0ha	Moderate Negligible	No longer affected	
CFA _{09/15} Farthings Wood	Temporary 0.4ha Permanent 0.4ha	Negligible Negligible	No longer affected	
CFA _{09/16} 94 King's Lane	Temporary 1.3ha Permanent 0.3ha	Moderate Moderate ⁷	No longer affected	
CFA _{09/17} part of which is Sibley's Coppice	Temporary 2.6ha Permanent 0.1ha	Moderate Negligible	Temporary 0.25ha Permanent 0.0 ha	Negligible No longer effected
CFA _{09/18} part of which is Sibley's Coppice	Temporary <0.1ha Permanent <0.1ha	Negligible Negligible	No longer affected	
CFA _{09/19} Gates Farm	Temporary 1.7ha Permanent 0ha	Major/moderate Negligible	No longer affected	
CFA _{09/20} Unnamed paddock	Temporary 2.3ha Permanent 0ha	Moderate Negligible	Temporary 2.3ha Permanent 1.8ha	Moderate Moderate

⁸ Includes commercial building demolition

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Holding reference/name	Area required for SES ₃ scheme	Assessment of adverse effect (as described in the main ES)	Area required for AP ₄ revised scheme	Assessment of effect (AP ₄ revised scheme)
CFA _{09/21}	Temporary 0.9ha	Moderate	Temporary 0.8ha	Moderate
Orchard Cottage	Permanent 0ha	Negligible	Permanent 0.7ha	Moderate
CFA _{09/22}	Temporary 0.7ha	Moderate	Temporary 0.7ha	Moderate
Frith Hill Farm	Permanent 0ha	Negligible	Permanent 0.7ha	Moderate
CFA _{09/23}	Temporary 0.1ha	Negligible	Temporary 0.1ha	Negligible
Cottage Farm	Permanent 0.1ha	Negligible	Permanent 0.1ha	Negligible
Unidentified holding	Temporary 0.4ha Permanent 0.4ha	Minor Minor	No longer affected	

- 5.1.83 In summary, the amendment affects considerably fewer holdings than the SES₃ scheme and a number of significant adverse effects will no longer arise. However, this benefit is partly offset by the introduction of significant effects to other holdings.
- 5.1.84 In total, 12 holdings will be affected by the AP₄ amendment compared to 22 in the SES₃ scheme.
- 5.1.85 Eight significant adverse temporary effects and five significant adverse permanent effects will no longer arise.
- 5.1.86 However, the amendment will result in different effects on four holdings, with three (CFA_{09/20}, CFA_{09/21} Orchard Cottage and CFA_{09/22} Frith Hill Farm) experiencing different effects which are significant moderate adverse permanent effects.
- 5.1.87 The amendment reduces the number of demolitions at residential properties within holdings by two (CFA_{09/5} and CFA_{09/16}) and the significant effects reported in the main ES at these two holdings will no longer arise. Additionally, one agricultural barn is no longer required to be demolished on one holding (CFA_{09/12}). The significant effects reported in the main ES on this holding due to demolition and a number of temporary and permanent effects during construction will no longer occur. One additional agricultural barn demolition is required as part of the amendment (CFA_{09/7}). This barn was not required for demolition in the SES₃ scheme though the residential property was, and remains, required for demolition under the AP₄ amendment which introduce a different significant effect although the level of significance remains as reported in the main ES.
- 5.1.88 The unidentified woodland holding that was identified as being affected by the AP₁ ES, will not now be affected if the AP₄ revised scheme is enacted.

Effects arising from operation

- 5.1.89 The extended Chiltern tunnel amendment will not give rise to a new or different significant effect and will not change the level of significance of the effects reported in the main ES during operation.

Mitigation and residual effects

- 5.1.90 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.
- 5.1.91 This amendment requires considerably less BMV agricultural land than the SES3 scheme, which constitutes a different significant effect although the level of significance of the effect remains the same as reported in the main ES (major/moderate adverse).
- 5.1.92 This amendment affects 10 fewer land holdings in comparison to the SES3 scheme.
- 5.1.93 Eight significant adverse temporary effects and five significant adverse permanent effects will no longer arise. There will also be different effects on three holdings (CFA09/20, CFA09/21 Orchard Cottage and CFA09/22 Frith Hill Farm), which are significant moderate adverse permanent residual effects. The main ES reported a negligible effect on these holdings during operation. As a result of the AP4 amendment these holdings will now experience a permanent moderate adverse significant residual effect.
- 5.1.94 The amendment reduces the number of demolitions at residential properties within holdings by two (CFA09/5 and CFA9/16), and the significant effects reported in the main ES at these two holdings will no longer arise. Additionally, one agricultural barn is no longer required to be demolished on one holding (CFA09/12). The significant effects reported in the main ES on this holding due to demolition and a number of temporary and permanent effects during construction will no longer occur. One additional agricultural barn demolition is required as part of the amendment (CFA09/7). This barn was not required for demolition in the SES3 scheme, though the residential property was, and remains, required for demolition under the AP4 amendment which introduce a different significant effect although the level of significance remains as reported in the main ES.

Cumulative effects

- 5.1.95 There are no new or different likely significant cumulative effects for agriculture, forestry and soils as a result of the AP4 amendments interacting with one another, the AP1 amendments, AP2 amendments or any relevant committed developments.

Community

Introduction

- 5.1.96 This section of the report describes the environmental baseline in relation to community that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the amendment, compared to those of the SES3 scheme. Consideration is given to impacts on residential properties, community resources, amenity, open space and PRoW.

Scope, assumptions and limitations

- 5.1.97 The assessment scope, key assumptions and limitations for community are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001 -000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2) of the main ES.
- 5.1.98 An area of 0.25ha of Sibley's Coppice is shown as falling within the land required for construction of the scheme (map reference CT-05-033 in the SES3 and AP4 ES, CFA9 Map Book). However, no works will be undertaken within this area in order to avoid any impacts on the ancient woodland present.

Existing baseline

- 5.1.99 A summary of the baseline information in the main ES relevant to the assessment of the amendment is provided below. Further details are provided in the main ES, Volume 2, CFA9, Section 5.

Hyde Heath

- 5.1.100 Hyde Heath is located north-west of Amersham and south-west of Great Missenden. The majority of Hyde Heath is south of Weedon Hill/Hyde Heath Road. Mantle's Wood, west of Hyde Heath, is an area of woodland, which is privately owned but is accessible to local residents by the provision of two PRoW (Footpaths LMI/17 and LMI/21).

Hyde End

- 5.1.101 The small village of Hyde End is located between Hyde Heath and South Heath on the B485 Chesham Road. There are no community facilities in the village.

South Heath

- 5.1.102 South Heath is located to the north-west of Hyde End and north-east of Great Missenden. It is centred on Frith Hill and Ballinger Road. Annie Bailey's public house and restaurant is located on the B485 Chesham Road and the Weights and Measures Gym is on Frith Hill. Sibley's Coppice is a 7ha area of woodland accessible to local residents for walking activities by the provision of several PRoW.

Future baseline

Construction (2017)

- 5.1.103 Volume 5, Appendix CT-004-000 of the SES3 and AP4 ES provides details of the developments that are assumed to have been implemented by 2017, additional to those identified in the main ES (Volume 2, CFA9, Section 5.3) and the SES and AP2 ES.
- 5.1.104 None of the identified developments affect the assessment of the AP4 amendment's likely construction impacts on community.

Operation (2026)

- 5.1.105 Volume 5, Appendix CT-004-000 of the SES3 and AP4 ES provides details of the developments that are assumed to have been implemented by 2017, additional to

those identified in the main ES (Volume 2, CFA9, Section 5.3) and the SES and AP2 ES.

- 5.1.106 None of the identified developments affect the assessment of the AP4 amendment's likely operational impacts on community.

Effects arising during construction

Temporary effects

Residential properties

- 5.1.107 The main ES reported the following significant temporary effects on residential properties in the village of South Heath due to construction activities associated with the South Heath green tunnel:

- significant effects for up to 40 residential properties due to in-combination visual and noise effects and increases in heavy goods vehicles (HGV) movements along Frith Hill;
- significant effects for approximately 50 residential properties due to in-combination noise effects and increases in HGV movements along King's Lane (between the B485 Chesham Road and Frith Hill); and
- significant effects for approximately 10 residential properties due to in-combination visual effects and increases in HGV movements along Potter Row (between Frith Hill and Leather Lane).

- 5.1.108 All of these significant temporary effects on residential properties will no longer arise as a result of the amendment.

- 5.1.109 The main ES also reported a minor adverse isolation (non-significant) effect for residents of South Heath and Ballinger Common, due to the temporary closure of Frith Hill which is the principal link between these villages and Great Missenden. The effect will no longer arise as a result of the amendment.

Open space

- 5.1.110 The main ES reported a significant effect on the community of South Heath due to the temporary loss (for up to two years) of a third of Sibley's Coppice (2.6ha), which is a valued community resource adjacent to the village.

- 5.1.111 As a result of the Chiltern tunnel extension amendment, land will no longer be required at Sibley's Coppice. This will enable residents of the village of South Heath to continue to use Sibley's Coppice throughout the construction phase and therefore, the significant effect will no longer arise.

Permanent effects

Residential properties

- 5.1.112 The main ES reported the following significant permanent effects on residential properties in the villages of Hyde End and South Heath due to the construction of the cutting and the South Heath green tunnel:

- the demolition of two residential properties (Rowen Farm and Hedgemoor) on

Hyde Lane; and

- the demolition of five residential properties in South Heath (one property on the B485 Chesham Road; two properties on King's Lane; one property on Frith Hill; and the residential property above the Annie Bailey's public house and restaurant on the B485 Chesham Road).

5.1.113 The Chiltern tunnel extension amendment removes the requirement for these demolitions and hence the significant permanent effects in Hyde End and South Heath will not occur.

Community infrastructure

5.1.114 The main ES reported the following significant effects on community infrastructure in the village of South Heath due to construction activities associated with the South Heath green tunnel:

- demolition of Annie Bailey's public house and restaurant on the B485 Chesham Road; and
- demolition of the Weights and Measures Gym on Frith Hill.

5.1.115 The Chiltern tunnel extension amendment removes the requirement for these demolitions and hence the significant permanent effects will not arise.

Open space

5.1.116 The main ES reported a significant permanent effect of Mantle's Wood, north-west of Hyde Heath. This effect was due to the permanent loss of approximately 31% of the wood and the permanent severance of the north section of the wood from the south.

5.1.117 The Chiltern tunnel extension amendment will remove the permanent requirement for land at Mantle's Wood so the significant effect will no longer arise.

Effects arising during operation

Permanent effects

Residential properties

5.1.118 The main ES reported the following significant permanent effects on residential properties associated with the operational phase:

- a significant effect on residential amenity for approximately six properties in the vicinity of Hyde Lane in Hyde End due to combined visual and operational noise effects; and
- a significant effect on residential amenity for approximately ten properties on Potter Row in South Heath due to combined visual and operational noise effects.

5.1.119 These significant effects on residential properties will no longer arise due to the amendment.

Mitigation and residual effects

- 5.1.120 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.
- 5.1.121 The following residual significant effects that were reported in the main ES for the construction phase will no longer arise at the following locations:
- significant temporary effects for up to 40 residential properties due to in-combination visual and noise effects and increases in HGV movements along Frith Hill;
 - significant temporary effects for approximately 50 residential properties due to in-combination noise effects and increases in HGV movements along King's Lane (between the B485 Chesham Road and Frith Hill);
 - significant temporary effects for approximately 10 residential properties due to in-combination visual effects and increases in HGV movements along Potter Row (between Frith Hill and Leather Lane);
 - significant temporary effects for residents of South Heath and Ballinger Common;
 - significant temporary effects for the community of South Heath due to Sibley's Coppice no longer being used during construction;
 - significant permanent effects on residential properties and community infrastructure during construction in the villages of Hyde End and South Heath because the demolitions reported in the main ES are no longer required; and
 - significant permanent effects on open space during construction will no longer arise because the amendment removes the permanent requirement for land at Mantle's Wood.
- 5.1.122 Significant permanent effects for residential properties during operation will no longer arise for approximately six properties in the vicinity of Hyde Lane in Hyde End due to combined visual and operational noise effects and for approximately 10 properties on Potter Row in South Heath due to combined visual and operational noise effects.
- 5.1.123 Changes to significantly affected community resources are shown on Maps CM-01-029 to CM-01-030 (SES3 and AP4 ES, Volume 5, Community Map Book).

Cumulative effects

- 5.1.124 There are no new or different likely significant cumulative effects for community as a result of the AP4 amendments interacting with one another, the AP1 amendments, AP2 amendments or any relevant committed developments.

Cultural heritage

Introduction

- 5.1.125 This section of the report describes the environmental baseline in relation to cultural heritage that is relevant to the assessment. It then identifies any new or different

likely significant environmental effects as a result of the amendment, compared to those of the SES3 scheme.

Scope, assumptions and limitations

- 5.1.126 The assessment scope, key assumptions and limitations for cultural heritage are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001 -000) and the SMR Addendum (Volume 5: Appendix CT-001-000) of the main ES.
- 5.1.127 An area of 0.25ha of Sibley's Coppice is shown as falling within the land required for construction of the scheme (map reference CT-05-033 in the SES and AP4 ES, CFA9 Map Book). However, no works will be undertaken within this area, which will avoid any impacts on the ancient woodland present.

Existing baseline

- 5.1.128 The cultural heritage baseline for the assessment takes into account information collected in support of the main ES, which included walk-over survey, geophysical survey, remote-sensing data, and data from national and local registers. A full list is provided in Volume 2, Section 6.3 of the main ES.
- 5.1.129 Along with the information provided in Volume 2, Section 6.3 of the main ES, a gazetteer of heritage assets is provided in Volume 5, CH-002-009 of the main ES, which describes the individual assets and their heritage value.

Future baseline

Construction (2017)

- 5.1.130 Volume 5, Appendix CT-004-000 of the SES3 and AP4 ES provides details of the developments that are assumed to have been implemented by 2017, additional to those identified in the main ES (Volume 2, CFA9, Section 6.3) and the SES and AP2 ES.
- 5.1.131 None of the identified developments affect the assessment of the AP4 amendment's likely construction impacts on cultural heritage.

Operation (2026)

- 5.1.132 Volume 5, Appendix CT-004-000 of the SES3 and AP4 ES provides details of the developments that are assumed to have been implemented by 2026, additional to those identified in the main ES (Volume 2, CFA9, Section 6.3) and the SES and AP2 ES.
- 5.1.133 None of the identified developments affect the assessment of the AP4 amendment's likely operational impacts on cultural heritage.

Effects arising during construction

- 5.1.134 Significant temporary and/or permanent construction effects were reported in the main ES for the following assets:
- Mantle's Wood (asset reference CCo19⁹) with a medium adverse impact

⁹ Asset reference: a unique code for each cultural heritage asset identified within the study area; further detail on these assets can be found in the gazetteer in Volume 5: Appendix CH-002-011 of the main ES.

resulting in a major adverse effect;

- parts of the Missenden Parish Boundary (asset reference CCo20 and CCo21) with a medium adverse impact resulting in a major adverse effect;
- Farthing's Wood (asset reference CCo30) with a medium adverse impact resulting in a major adverse effect;
- prehistoric artefacts on land to the north of Rowan Farm (asset reference CCo34) with a high adverse impact resulting in a major adverse effect;
- two Grade II Listed buildings at Hyde Farm (asset reference CCo36) with a temporary high adverse impact resulting in a major adverse effect and a permanent medium adverse impact resulting in a moderate adverse effect;
- The Castle, Rook Wood (asset reference CCo38), a Scheduled Monument with a temporary low adverse impact resulting in a moderate adverse effect;
- the post-medieval Chapel Farm (asset reference CCo42) with a temporary high adverse impact resulting in a moderate adverse effect;
- the Grade II Listed Sheepcotts (asset reference CCo43) with a temporary high adverse impact resulting in a moderate adverse effect;
- Sheepcotts Cottage (asset reference CCo45) with a temporary high adverse impact resulting in a major adverse effect and a permanent medium adverse impact resulting in a moderate adverse effect;
- the Grade II Listed Briarwood (asset reference CCo46) with a temporary medium adverse impact resulting in a moderate adverse effect;
- the Grade II Listed Granary at Cudsden's Farm (asset reference CCo47) with a temporary high adverse impact resulting in a major adverse effect;
- the Grade II Listed 86 King's Lane (asset reference CCo48) with a temporary high adverse impact resulting in a major adverse effect;
- the Grade II Listed South Heath Farmhouse (asset reference CCo49) with a temporary medium adverse impact resulting in a temporary moderate adverse effect;
- Sibley's Coppice (asset reference CCo50) with a medium adverse impact resulting in a major adverse effect;
- Missenden Abbey Registered Park (asset reference CCo51) with a temporary low adverse impact resulting in a moderate adverse effect;
- moated site in Chalkdell Wood (asset reference CCo54), a Scheduled Monument with a temporary low adverse impact resulting in a moderate adverse effect;
- the post-medieval Annie Bailey's public house and restaurant (asset reference CCo55) with a high adverse impact resulting in a moderate adverse effect;
- the post-medieval Chiltern Cottage (asset reference CCo60) with a high

adverse impact resulting in a moderate adverse effect;

- the post-medieval Weights and Measures Gym (asset reference CCo61) with a high adverse impact resulting in a moderate adverse effect;
- prehistoric artefacts on land between Chesham Road and Frith Hill (asset reference CCo64) with a medium adverse impact resulting in a moderate adverse effect;
- Bury Farm (asset reference CCo70) with a temporary medium adverse impact resulting in a temporary moderate adverse effect, and a permanent medium adverse effect resulting in a moderate adverse effect;
- Hammondshall Farm (asset reference CCo94), with a temporary high adverse impact resulting in a temporary major adverse effect, and a permanent medium adverse impact resulting in a moderate adverse effect; and
- Mantle’s Wood Earthworks (asset reference CC109) with a medium adverse impact resulting in a major adverse effect.

Extension to the Chiltern tunnel

- 5.1.135 The extension of the Chiltern bored tunnel portal from Mantle’s Wood to the north-west of South Heath will result in a reduction in land required by approximately 43ha. Heritage assets, including archaeological remains, within this land will no longer be physically impacted by the scheme. This has resulted in the significant effects on the following heritage assets as a result of their physical loss no longer arising:
- Mantle’s Wood (asset reference CCo19);
 - parts of the Missenden Parish Boundary (asset references CCo20 and CCo21);
 - Farthing’s Wood (asset reference CCo30);
 - prehistoric artefacts on land to the north of Rowan Farm (asset reference CCo34);
 - Sibley’s Coppice (asset reference CCo50);
 - prehistoric artefacts on land between Chesham Road and Frith Hill (asset reference CCo64); and
 - Mantle’s Wood earthworks (asset reference CC109).
- 5.1.136 The setting of South Heath Farmhouse (asset reference CCo49) will also no longer be affected by the scheme. This is because the amendment is at an increased distance from the asset, with intervening properties separating the property from the scheme. The setting of South Heath Farmhouse will no longer be altered to the extent where it affects the heritage asset’s value.
- 5.1.137 The amendment will reduce the level of impact due to changes to the setting of the following heritage assets, resulting in the significant effects reported in the main ES no longer occurring. This is due to the reduction in the amount of the surrounding agricultural landscape required for the amendment, where the agricultural setting contributes to the asset’s value:

- The Castle, Rook Wood (asset reference CCo38) with a temporary minimal adverse impact resulting in a minor adverse effect, which is not significant;
- Missenden Abbey (asset reference CCo51) with a temporary minimal adverse impact resulting in a minor adverse effect, which is not significant; and
- moated site in Chalkdell Wood (asset reference CCo54) with a temporary minimal adverse impact resulting in a minor adverse effect, which is not significant.

5.1.138 Chiltern Cottage (asset reference CCo60) and Weights and Measures Gym (asset reference CCo61) were to be demolished. With the AP4 amendment, these buildings will now be retained. This means that the permanent significant construction effect will no longer arise. This has also resulted in a change to the significant temporary effects reported in the main ES. Although the buildings will now be retained, they will be within 150m of the land required for the construction of the north portal. This will result in temporary high adverse impacts resulting in moderate adverse effects due to changes to their settings from construction activities. This effect is significant and a different effect from that reported in the main ES.

5.1.139 The amendment will result in a different significant effect for Bury Farm (asset reference CCo70) and Hammondshall Farm (asset reference 094), although the level of effect reported in the main ES (moderate adverse) will remain the same. This is a result of the construction of the noise fence barrier and associated landscaping at the top of the cutting. This will result in the further severance of the assets from their setting, the agricultural landscape, and interruption of views across the landscape, but not of such scale as to change the magnitude of impact.

Chesham Road ventilation shaft and auto-transformer station

5.1.140 The amendment at Chesham Road ventilation shaft will reduce the level of impact on the following heritage assets, resulting in the removal of the significant effects reported in the main ES. This is due to the removal of construction activity for the South Heath cutting, South Heath green tunnel and associated landscaping. A temporary impact will remain as a result of construction activity required for the new ventilation shaft. This has resulted in the removal of significant effects from the following heritage assets:

- Hyde Farm (asset reference CCo36) –the impact is reduced to temporary low adverse resulting in a temporary minor adverse effect;
- Chapel Farm (asset reference CCo43) – the impact is reduced to temporary medium adverse resulting in a minor adverse effect;
- Sheepcotts (asset reference CCo43) – the impact is reduced to temporary medium adverse resulting in a minor adverse effect; and
- 86 King’s Lane (asset reference CCo48) – the impact is reduced to temporary low adverse resulting in a minor adverse effect.

5.1.141 The level of significance of the effect reported in the main ES will be reduced for Sheepcotts Cottage (asset reference CCo45) and The Granary at Cudsden’s Farm (asset reference CCo47). The magnitude of the temporary impact will be reduced to

medium adverse due to construction activities associated with the new ventilation shaft, resulting in a moderate adverse effect which is significant. The impact and subsequent effects of the construction of the South Heath cutting, South Heath green tunnel and associated landscaping from the SES3 scheme will no longer arise.

- 5.1.142 There will be a different significant effect on Briarwood (asset reference CCo46) and artefacts on land between Hedgemoor Wood and Cudsden’s Farm (asset reference CCo35), although the level of impact and subsequent effect reported in the main ES remains unchanged. The impact is due to the construction activity at the new ventilation shaft rather than the construction works associated with the SES3 scheme, namely the South Heath cutting, South Heath green tunnel and associated landscaping.
- 5.1.143 Annie Bailey’s public house and restaurant (asset reference CCo55) was to be demolished as result of the SES3 scheme. Under the AP4 amendment the building will now be retained and the permanent significant construction effect no longer occurs. This has resulted in the removal of a significant effect reported in the main ES. Although the building will now be retained, it will be 10m north of the land required for the construction of the new ventilation shaft. There will be a significant temporary adverse impact resulting in moderate adverse effects to its setting from construction activities, which is significant and a different effect from that reported in the main ES.

Little Missenden ventilation shaft

- 5.1.144 No additional land is required for the proposed alterations to Little Missenden ventilation shaft and there will be no further impact on the setting of any heritage assets from the construction of the amendment. Therefore, there is no change to the significant effects reported in the main ES.
- 5.1.145 The alteration to the Little Missenden ventilation shaft will not give rise to a new or different significant effect and will not change the level of significance of the effects reported in the main ES.

Effects arising from operation

- 5.1.146 Significant operational effects were reported in the main ES to Hyde Farm (asset reference CCo36) and Sheepcotts Cottage (asset reference CCo45) with medium impacts resulting in moderate adverse significant effects. This was a result of noise and visual intrusion from passing trains in the South Heath cutting. As the route will now be in a bored tunnel at this location, the significant effects upon these assets from passing trains will no longer arise.

Mitigation and residual effects

- 5.1.147 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.
- 5.1.148 Significant effects on the following heritage assets during construction will no longer arise as a result of the amendment: Mantle’s Wood (asset reference CCo19), parts of the Missenden Parish Boundary (asset references CCo20 and CCo21), Farthing’s Wood (asset reference CCo30), artefacts on land to the north of Rowan Farm (asset reference CCo34), Sibley’s Coppice (asset reference CCo50), artefacts on land

between Chesham Road and Frith Hill (asset reference CCo64) and Mantle’s Wood earthworks (asset reference CC109).

- 5.1.149 The setting of South Heath Farmhouse (asset reference CCo49) will also no longer be affected by the scheme.
- 5.1.150 The amendment will remove the significant effect on the setting of the following heritage assets during construction: The Castle, Rook Wood (asset reference CCo38), Missenden Abbey (asset reference CCo51), and moated site in Chalkdell Wood (asset reference CCo54).
- 5.1.151 At the Chesham Road ventilation shaft, significant effects will no longer arise at the following heritage assets: Hyde Farm (CCo36), Chapel Farm (asset reference CCo43), Sheepcotts (asset reference CCo43) and 86 King’s Lane (asset reference CCo48).
- 5.1.152 The amendment will result in a different significant effect (a temporary high adverse impact resulting in moderate adverse effects) at Chiltern Cottage (asset reference CCo60), and Weights and Measures Gym (asset reference CCo61) due to changes to construction activity on their settings in this area.
- 5.1.153 The amendment will result in a different significant impact for Bury Farm (asset reference CCo70) and Hammondshall Farm (asset reference 094) during construction although the level of effect reported in the main ES (moderate adverse) will remain the same.
- 5.1.154 A different significant effect will occur at Sheepcotts Cottage (asset reference CCo45) and The Granary at Cudsden’s Farm (asset reference CCo47) resulting in a reduced temporary medium adverse impact from construction activities associated with the new ventilation shaft resulting in a moderate adverse effect which is significant.
- 5.1.155 There will be a different significant effect on Briarwood (asset reference CCo46) and artefacts on land between Hedgemoor Wood and Cudsden’s Farm (asset reference CCo35) although the level of impact and subsequent effect reported in the main ES (moderate adverse) remains unchanged.
- 5.1.156 Annie Bailey’s public house and restaurant (asset reference CCo55) was to be demolished as result of the SES3 scheme. Under the AP4 amendment, the building will now be retained and the permanent significant construction effect will no longer arise.
- 5.1.157 There will however be a different significant effect due to construction activities at the Chesham Road ventilation shaft. There will be a significant temporary adverse impact resulting in a moderate adverse effect to its setting from construction activities, which is significant.
- 5.1.158 Significant operational effects will no longer arise at Hyde Farm (asset reference CCo36) and Sheepcotts Cottage (asset reference CCo45).

Cumulative effects

- 5.1.159 There are no new or different likely significant cumulative effects for cultural heritage as a result of the AP4 changes interacting with one another, the AP1 amendments, AP2 amendments or any relevant committed developments.

Ecology

Introduction

- 5.1.160 This section of the report describes the environmental baseline in relation to ecology that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the amendment, compared to those of the SES3 scheme.

Scope, assumptions and limitations

- 5.1.161 Updates to the scope of the assessment for ecology are set out in Volume 1 of the SES3 and AP4 ES. The key assumptions and limitations, and the methodology for determining significance of effects are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/01) and the SMR Addendum (Volume 5: Appendix CT-001-000/02) of the main ES.
- 5.1.162 To address any limitations in data, a precautionary baseline has been considered according to the guidance reported in the main ES, Volume 5: Appendix CT-001-000/2. This constitutes a 'reasonable worst-case' basis for the subsequent assessment. The precautionary approach to the assessment that has been adopted identifies the likely significant ecological effects of the AP4 revised scheme.

Existing baseline

- 5.1.163 The ecological baseline of the land required for the amendment has been based on field data collated for the main ES, additional survey work for great crested newt undertaken in 2014 and 2015, aerial photography and relevant existing information gathered from national organisations and from regional and local sources including: Buckinghamshire and Milton Keynes Environmental Records Centre; Berkshire, Buckinghamshire and Oxfordshire Wildlife Trust, Chilterns Conservation Board; North Bucks Bat Group, Berkshire and South Buckinghamshire Bat Group, Buckinghamshire Bird Club, and Buckinghamshire Amphibian and Reptile Group.
- 5.1.164 A summary of the baseline information relevant to the assessment of the amendment is provided below. This takes account of any relevant 2015 survey information provided in SES3 and AP4 ES, Volume 5: Appendix EC-001-002. For those receptors described in the main ES, further details are provided in Volume 2, CFA9, Section 7.3 of the main ES and in Volume 5, including maps EC-01 to EC-12 of the main ES.

Designated sites

- 5.1.165 There are no statutory designated sites relevant to the assessment.
- 5.1.166 There are six non-statutory Local Wildlife Sites (LWSs) of relevance to the assessment:
- Weedon Hill Wood/High Springs/Ostler's Woods LWS (49.9ha) is located immediately adjacent to land required for the construction of the Little Missenden ventilation shaft in both the SES3 scheme and the amendment;
 - Mantle's Wood LWS (20.5ha) is designated on the basis of its ancient woodland. It is located above the extension of the bored tunnel, outside of the land required for the amendment;

- Hedgemoor and Farthings Wood LWS (12.9ha) lies above the extension of the bored tunnel and is designated for deciduous woodland, parts of which qualify as a habitat of principal importance;
- Rook Wood LWS (30.9ha) is 500m west of the land required for diversion of the overhead cables west of Hyde Farm;
- Sibley’s Coppice LWS (7.5ha) lies above the extension of the bored tunnel and is 250m south-east of the north tunnel portal; and
- Stockings Wood LWS (2.1ha) is 150m east of land required for the temporary north portal access road.

- 5.1.167 All of these LWS are designated for woodland, including areas of broadleaved ancient semi-natural and ancient replanted woodland. Parts of the sites qualify as a habitat of principal importance as identified in Section 41 of the Natural Environment and Rural Communities Act (2006)¹⁰ and local biodiversity action plan (BAP) habitat. The main ES reported that Mantle's Wood LWS, Hedgemoor and Farthings Wood LWS, Weedon Hill Wood/High Springs/Ostler's Woods LWS, and Rock Wood LWS were each of county/metropolitan value.
- 5.1.168 Stockings Wood LWS was not evaluated in the main ES, but is also considered to be of county/metropolitan value.
- 5.1.169 Three Biological Notification Sites (BNSs) are adjacent to land required for ecological compensation in the SES3 scheme (Hyde Heath Common BNS; Hyde House Wood BNS; and Hyde Lane Verge BNS), and are reported in the main ES to be of county/metropolitan value. However, all three sites are more than 450m from the land required for the amendment, and therefore are no longer relevant to the assessment.
- 5.1.170 In addition to the ancient woodland in the non-statutory designated sites, there are three areas of ancient woodland adjacent to the land required for both the SES3 scheme and the AP4 amendment. These are: Jenkin’s Wood (3.1ha), Stockings Wood (1.3ha) and Havenfield Wood (2.9ha); all of which qualify as lowland mixed deciduous woodland, a habitat of principal importance and as a local BAP habitat.

Habitats

- 5.1.171 None of the areas of ancient woodland are within land required for the AP4 amendment. The areas of ancient woodland within each LWS described above are of county/metropolitan value as reported in the main ES.
- 5.1.172 The areas of semi-natural broad-leaved woodland which do not form part of the ancient woodland located within the designated sites described above are reported in the main ES as being of district/borough value.
- 5.1.173 There are six areas of woodland of relevance to the SES3 scheme. Five of which are either fully or partly ancient and all qualify as a habitat of principal importance and are a local BAP habitat. None of these woodlands lie within land required for the amendment.

¹⁰ Natural Environment and Rural Communities Act 2006 (Chapter 16). London. Her Majesty’s Stationery Office.

The following woodlands are each of country/metropolitan value as stated in the main ES:

- Weedon Hill Wood/High Springs/Ostler's Woods;
- Mantle's Wood;
- Hedgemoor and Farthings Wood;
- Rook Wood;
- Sibley's Coppice; and
- Hyde House Wood and Hyde Heath Common Wood.

5.1.174 Ancient woodland in Stockings Wood (1.3ha) is considered to be of country/metropolitan value due to its proximity to Stockings Wood LWS. This area of ancient woodland is 150m east of land required for the temporary north portal access road. Jenkin's Wood and Havenfield Wood are both ancient woodland but smaller in extent and more isolated than the woodlands described above. The main ES reports that they are each of district/borough value. They are adjacent to the land required for both the SES3 scheme and the amendment.

5.1.175 The main ES reports that there are 19 important hedgerows in the Central Chilterns area (CFA9). Due to the number of established hedgerows and the connectivity they provide between the ancient woodlands, the hedgerow network is of district/borough value, as stated in the main ES.

5.1.176 The 10.6ha of additional land required as part of the AP4 amendment for the temporary construction road to the new Chiltern tunnel north portal is immediately adjacent to Stockings Wood and 150m east of Stockings Wood LWS. The land required for this construction road comprises improved grassland, semi-improved grassland and arable land which is valued as part of the wider resource of improved grassland, semi-improved grassland and arable land assessed in the main ES. The new Chesham Road ventilation shaft lies within an area of arable land that was also required for the SES3 scheme.

5.1.177 The main ES reports that areas of arable and cultivated land, improved grassland, semi-improved grassland and ponds within land required for the SES3 scheme are all of local/parish value.

Protected and/or notable species

5.1.178 The main ES reports that breeding barn owl territories were recorded between Little Missenden and Great Missenden. Barn owls have a restricted distribution and are a scarce breeding species in Buckinghamshire. This population is of county/metropolitan value.

5.1.179 The main ES reports the potential presence of hazel dormouse in Hedgemoor and Farthings Wood. Field surveys close to Mantle's Wood and at Sibley's Coppice recorded no evidence of this species. The main ES states that small populations of hazel dormouse in Hedgemoor and Farthings Wood, if present, are of up to county/metropolitan value.

- 5.1.180 The main ES identifies a number of ponds with suitable habitat to support great crested newt in CFA9 of which three populations are relevant to the amendment as follows:
- a small breeding population of great crested newt in a pond 230m north-east of Mantle’s Wood. This population is of district/borough value;
 - a potential medium-sized population of great crested newt in a pond near Chesham Road, 50m east of the Chesham Road ventilation shaft, which is of up to county/metropolitan value. However, eDNA surveys in 2015 have shown that great crested newt are likely to be absent from this pond as reported in Part 1 of this report; and
 - a pond near Kennel Farm, 200m west of the Little Missenden ventilation shaft, which has the potential to support medium populations of breeding great crested newt (see Part 1 of the SES and AP2 ES). Surveys in 2014 have shown that great crested newt are likely to be absent from this pond.
- 5.1.181 Four bat assemblages reported in the main ES are of relevance to the amendment. A maternity roost for common pipistrelle bat in a residential building near Park Farm lies within land required for both the SES3 scheme and the AP4 amendment. The main ES states that two summer/transient common pipistrelle roosts were recorded in the same building complex, each with low numbers of bats. The common pipistrelle population near Park Farm is of county/metropolitan value as stated in the main ES.
- 5.1.182 The bat assemblage associated with habitat near Park Farm includes soprano pipistrelle bat, serotine and noctule bat. The hedgerows and trees within land required for both the SES3 scheme and AP4 amendment provide suitable commuting and foraging habitat for this assemblage. The main ES reports that the bat assemblage associated with habitat near Park Farm is of district/borough value.
- 5.1.183 Woodland and hedgerows around Mantle’s Wood support foraging and commuting activity of at least six species of bat, including low numbers of uncommon species (Leisler’s bat and serotine). It is assumed that bat tree roosts for common species are also present within Mantle’s Wood. The bat assemblage associated with the network of woodland, hedgerows and tree-lined roads around South Heath consists of at least four species: common pipistrelle (in low numbers) and individuals of soprano pipistrelle, *Myotis* species and noctule. Both assemblages are of district/borough value.
- 5.1.184 The main ES reports that the invertebrate assemblages associated with the woodland edge at Mantle’s Wood and at Sibley’s Coppice are both of district/borough value.
- 5.1.185 The main ES reports that habitat suitable to support reptiles is abundant throughout the Central Chilterns area (CFA9). Potential populations of reptiles in this area are up to district/borough value.
- 5.1.186 The main ES reports that the presence of box (an evergreen shrub) at Mantle's Wood and wood barley near South Heath are both of district/borough value. It also reports that there is potential for rare and notable plants, including coralroot near Weedonhill Wood/High Springs/Ostler's Woods to be present elsewhere in the area, which would be of up to district/borough value.

- 5.1.187 A badger population is known to utilise Mantle’s Wood, and the land required by the SES₃ scheme for the Chiltern tunnel north portal extension. As reported in the main ES, the badger population in the area is of local/parish value.

Future baseline

Construction (2017)

- 5.1.188 Volume 5, Appendix CT-004-000 of the SES₃ and AP₄ ES provides details of the developments that are assumed to have been implemented by 2017, additional to those identified in the main ES (Volume 2, CFA₉, Section 7.3) and the SES and AP₂ ES.
- 5.1.189 None of the identified developments affect the assessment of the AP₄ amendment’s likely construction impacts on ecology.

Operation (2026)

- 5.1.190 Volume 5, Appendix CT-004-000 of the SES₃ and AP₄ ES provides details of the developments that are assumed to have been implemented by 2026, additional to those identified in the main ES (Volume 2, CFA₉, Section 7.3) and the SES and AP₂ ES.
- 5.1.191 None of the identified developments affect the assessment of the AP₄ amendment’s likely operational impacts on ecology.

Effects arising during construction

Avoidance and mitigation measures

- 5.1.192 The assessment assumes implementation of the measures set out within the draft CoCP (Volume 5: Appendix CT-003-000 of the main ES), which includes translocation of protected species where appropriate.
- 5.1.193 The new Chiltern tunnel north portal temporary construction road avoids Stockings Wood.
- 5.1.194 An area of approximately 0.25ha of Sibley’s Coppice is shown as falling within the land required for the scheme. However, no works will be undertaken within this area in order to avoid any impacts on the ancient woodland present.

Designated sites

- 5.1.195 The main ES identified that habitat loss and increased isolation arising from the original scheme would result in a permanent adverse effect on the integrity of Mantle’s Wood LWS, Hedgemoor and Farthings Wood LWS and Sibley’s Coppice LWS that would in each case be significant at the county/metropolitan level.
- 5.1.196 For the AP₄ amendment, the extension of the bored tunnel results in no loss or fragmentation of habitat within the LWS sites and therefore, the significant effects on these LWS reported in the main ES will not occur.

Habitats

- 5.1.197 The SES₃ scheme would result in the removal of 6.2ha of ancient woodland from Mantle’s Wood, 0.5ha from Farthings Wood and 2.5ha from Sibley’s Coppice. An additional 3ha of woodland that qualifies as a habitat of principal importance (but which is not ancient woodland) would be removed from Farthings Wood. Ancient

woodland cannot be replaced and the main ES concludes that the resultant adverse effect on the conservation status of these woodlands would be significant in each case at the county/metropolitan level.

- 5.1.198 The amendment extends the bored tunnel under Mantle’s Wood, Farthings Wood and Sibley’s Coppice resulting in no habitat loss or fragmentation within these woodlands. The loss of approximately 9.2ha of ancient woodland and a further 3ha of non-ancient woodland that would occur at these woodlands in the SES₃ scheme will not occur with the AP₄ amendment. The amendment will therefore mean that the significant effects at the county/metropolitan level on woodlands at Mantle’s Wood, Farthings Wood and Sibley’s Coppice reported in the main ES will no longer arise.
- 5.1.199 The main ES reports that 16km of hedgerows in CFA₉ would be removed in the land required for the SES₃ scheme, including 2.1km of important hedgerows. The loss of hedgerows between Mantle's Wood and Sibley's Coppice would fragment the network in an area where it provides the only connectivity across the arable landscape. Habitat loss of this extent would result in a permanent adverse effect on the conservation status of the habitat that would be significant at the district/borough level.
- 5.1.200 Approximately 6.3km of hedgerows will be lost as result of the construction of the amendment. The extension of the bored tunnel will result in 425m of important hedgerows between Mantle’s Wood and Sibley’s Coppice being retained and there will be no loss of species-rich hedgerows or fragmentation of the hedgerow network in the vicinity of the amendment. However, while the amendment results in a reduction in the loss of important hedgerows, up to 1.9km of important hedgerows will still be permanently lost in this area due to the amendment.
- 5.1.201 The amendment will result in a reduction in hedgerow loss totalling approximately 10km and as a consequence will result in a different significant effect on the conservation status of hedgerows. However, this will not change the level of significance reported in the main ES.
- 5.1.202 The main ES does not report any adverse effects on the ancient woodland located at Stockings Wood (to the north of Stockings Wood LWS). The land required for the amendment is adjacent to Stockings Wood, however, it is expected that a buffer zone of approximately 25m will be maintained between the construction works and the woodland. With the implementation of the CoCP there is unlikely to be any significant adverse effect on Stockings Wood.
- 5.1.203 The loss of additional improved, semi-improved and arable land required for the temporary construction road to the new Chiltern tunnel north portal will not give rise to a new or different significant effect and will not change the level of significance of the effects reported in the main ES.
- 5.1.204 It is unlikely that the amendment will result in any other new or different effects on habitat receptors of relevance at more than the local/parish level. Local/parish level effects, which are in addition to those identified in the main ES and the SES and AP₂ ES, are listed in Volume 5: Appendix EC-003-002 of the SES₃ and AP₄ ES.

Protected and/or notable species

- 5.1.205 The main ES reports on a precautionary basis that the habitat loss and fragmentation within Hedgemoor and Farthings Wood could result in a permanent adverse effect on the conservation status of hazel dormouse that would be significant at up to county/metropolitan level. The AP4 amendment does not give rise to habitat loss or fragmentation of Hedgemoor and Farthings Wood and avoids damage to the hedgerows that connect these woodlands to Mantle's Wood and Rook Wood. Consequently, the precautionary adverse effects on the conservation status of hazel dormouse associated with Hedgemoor and Farthings Wood reported in the main ES will not occur.
- 5.1.206 The main ES reports that removal of trees with potential for roosting bats and fragmentation of habitat providing flight lines would occur for the construction of the Chiltern tunnel, Chiltern tunnel north cutting and South Heath green tunnel. The adverse effect on the conservation status of the bat assemblages in habitat around Mantle's Wood and the South Heath area is significant at a district/borough level. The amendment does not result in fragmentation of commuting or foraging habitat used by bat assemblages around Mantle's Wood. The amendment will therefore mean that the significant effect on bat assemblages in habitat around Mantle's Wood reported in the main ES will no longer arise.
- 5.1.207 The main ES reports that the removal of potential tree roosts during vegetation clearance and construction of the South Heath cutting, which will fragment linear vegetation that provide flight lines for bats, will result in an adverse effect on the bat assemblage near South Heath. This would be significant at up to the district/borough level. There is no habitat loss within Sibley's Coppice as a result of the amendment and therefore the adverse effect will no longer arise. The extension of the Chiltern tunnel also results in a reduction in the extent of removal of hedgerows and trees near South Heath compared to the SES3 scheme. However, the extent of land required for the construction of the Chilterns tunnel north portal and the habitat loss and fragmentation that will still occur as a result of the construction of South Heath cutting, will give rise to a different significant effect on the conservation status of the bat assemblage associated with habitat near South Heath, although it will not change the level of significance of the effects reported in the main ES.
- 5.1.208 The main ES reports that the construction of the Chiltern tunnel north portal will remove a pond and associated terrestrial habitat used by a small breeding population of great crested newt, and that this would result in a permanent adverse effect on the conservation status of the population, significant at the district/borough level. This pond will no longer be lost as a result of the AP4 amendment; therefore the adverse effects on great crested newt associated with the pond near Mantle's Wood will not now occur.
- 5.1.209 The main ES reports that the construction of the Chiltern tunnel north portal and the South Heath green tunnel would reduce the quantity of available deadwood and other habitat features in woodland at both Mantle's Wood LWS and Sibley's Coppice LWS. This would likely result in a permanent adverse effect on the conservation status of terrestrial invertebrates at both sites that is significant at the district/borough level. The amendment results in no loss of habitat from either LWS. Therefore, the adverse

effects on notable terrestrial invertebrates at Mantle's Wood LWS and Sibley's Coppice LWS reported in the main ES will not occur.

- 5.1.210 As reported in the main ES, the removal of coralroot, box and other notable plant species would result in a permanent adverse effect on the conservation status of the affected populations that would be significant at up to the district/borough level. The amendment does not result in vegetation clearance in Mantle's Wood, Hedgemoor and Farthings Wood or Sibley's Coppice and will therefore avoid any loss of notable woodland plant species from these sites. Therefore, the significant effect on the population of coralroot reported in the main ES will not occur. However, the South Heath cutting will still remove hedgerow habitat in the north of this area, and the potential for adverse effects on the conservation status to wood barley and box remain. The amendment will therefore result in a different significant effect on the conservation status of wood barley and box. However, this will not change the level of significance of the effects reported in the main ES.
- 5.1.211 The main ES reports that the loss of grassland, field margins and hedgerows as part of the SES3 scheme would result in a permanent adverse effect on the conservation status of reptiles that would be significant at up to the district/borough level. The AP4 amendment reduces the loss of habitat suitable for reptiles. However, the South Heath cutting will still remove hedgerows and field margins in the north of this area; and semi-improved grassland and hedgerows within the additional land required adjacent to the temporary construction access track near Stockings Wood is potentially suitable for reptiles. The potential for adverse effects therefore remains. The amendment will therefore result in a different significant effect on the conservation status of common reptiles. However, the amendment will not change the level of significance of the effects reported in the main ES.
- 5.1.212 It is unlikely that the amendment will result in any other new or different effects on species receptors of relevance at more than the local/parish level. Local/parish level effects, which are in addition to those identified in the main ES and the SES and AP2 ES, are listed in Volume 5: Appendix EC-003-002 of the SES3 and AP4 ES.

Cumulative effects

- 5.1.213 There are no new or different likely significant cumulative effects for ecology as a result of the AP4 amendment interacting with one another or any AP1 amendments, or AP2 amendments or any relevant committed developments.

Mitigation and residual effects

Other mitigation measures

- 5.1.214 The main ES states that five areas of lowland mixed deciduous woodland would be created near South Heath. These areas of woodland habitat creation would have compensated for habitat loss at Mantle's Wood LWS, Hedgemoor and Farthings Wood LWS and Sibley's Coppice LWS. They are:
- 16ha immediately south of the SES3 scheme's Chiltern tunnel north portal;
 - 8ha approximately 400m to the west of the Hedgemoor and Farthings Wood LWS;

- 3ha to connect the new woodland described above to the Hyde House Wood BNS and Hyde Heath Common BNS;
- 3ha to extend the remaining 5ha of the Sibley's Coppice LWS; and
- 10ha on South Heath green tunnel to connect Sibley's Coppice to Wendover Woods.

5.1.215 The amendment will involve no habitat loss at Mantle's Wood LWS, Hedgemoor and Farthings Wood LWS and Sibley's Coppice LWS, therefore none of the above mitigation is required. If the AP4 amendment is approved, the habitat creation will therefore be removed from the scheme.

5.1.216 The amendment also reduces the extent of mitigation required to compensate for loss and fragmentation of hedgerows as well as habitats suitable for reptiles, great crested newt and notable plant species in CFA9. With the amendment, the following areas of ecological mitigation will be retained, which are considered sufficient to address the different significant effects on these receptors:

- two areas of pond and grassland creation near Park Farm, one of 2.1ha and one of 1.2ha, to provide compensatory habitat for reptiles and great crested newt; and
- 0.9ha of planting, including hedgerows, to provide habitat connectivity along the realignment of Leather Lane.

5.1.217 The main ES stated that compensatory roosting habitat to address the loss of a common pipistrelle maternity roost near Park Farm would be provided at the margin of the retained woodland near Sibley's Coppice. As this mitigation area is no longer required as part of the amendment, compensatory roosting habitats will instead be provided within the 2.1ha ecological compensation area, adjacent to Jenkin's Wood.

5.1.218 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.

Summary of likely residual effects

5.1.219 The main ES reported likely significant residual effects on Mantle's Wood, Hedgemoor and Farthings Wood and Sibley's Coppice due to the combined loss of approximately 9ha of ancient woodland. As a result of the amendment, the adverse residual effects significant at the county/metropolitan level reported in the main ES will not occur.

Effects arising from operation

Avoidance and mitigation measures

5.1.220 No avoidance and mitigation measures additional to those reported in the main ES are required.

Designated sites

5.1.221 The amendment will not give rise to new or different significant effects on designated sites and will not change the level of significance of the effects reported in the main ES.

Habitats

- 5.1.222 The amendment will not give rise to a new or different significant effect on habitats and will not change the level of significance of the effects reported in the main ES or the SES and AP2 ES.

Protected and/or notable species

- 5.1.223 A barn owl nest at Mantle's Farm Cottages is within 350m of the Chiltern tunnel north cutting in the SES3 scheme. The main ES states that the increased risk of train strike on barn owls south of South Heath would result in a permanent adverse effect on the conservation status of this species that would be significant at up to the county/metropolitan level.
- 5.1.224 The amendment extends the bored tunnel 2.6km past the barn owl nest and will therefore remove the risk of barn owl mortality from contact with trains. The proposed amendment to extend the bored tunnel to South Heath will therefore mean that the significant effect on the conservation status of barn owl reported in the main ES will not occur.

Cumulative effects

- 5.1.225 There are no new or different likely significant cumulative effects for ecology as a result of the AP4 changes interacting with one another, the AP1 amendments, AP2 amendments or any relevant committed developments.

Mitigation and residual effects

Other mitigation

- 5.1.226 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.

Summary of likely residual effects

- 5.1.227 As a result of the amendment to extend the bored tunnel to South Heath, the significant residual effect on the conservation status of barn owl in this area reported in the main ES will no longer occur.

Landscape and visual assessment

Introduction

- 5.1.228 This section of the report describes the environmental baseline in relation to landscape and visual that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the amendment, compared to those of the SES3 scheme.

Scope, assumptions and limitations

- 5.1.229 The assessment scope, key assumptions and limitations for the landscape and visual assessment are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2) of the main ES. An update to the methodology for the landscape and visual assessment is also described in Volume 1 of the AP1 ES and Volume 1 of the SES and AP2 ES.

Existing baseline

- 5.1.230 A summary of the baseline information in the main ES relevant to the assessment of the amendment is provided below. Further details are provided in the main ES Volume 2, CFA9, Section 9; and maps are provided in Volume 5: Appendix LV-001-009.
- 5.1.231 The amendment is located within the Misbourne Upper North Landscape Character Area (LCA) (Little Missenden ventilation shaft, tunnel extension), the Hyde Heath North LCA (Chesham Road ventilation shaft and tunnel extension), the Lee and Buckland Common Farmland LCA (tunnel extension, compounds, access road stockpiles), as described in the main ES (Volume 2, CFA9, Section 9). All three LCAs are within the Chilterns AONB.
- 5.1.232 Misbourne Upper North LCA and Hyde Heath North LCA have a medium level of tranquillity, are of national value, are in fair condition and are considered to be of high sensitivity to change. Lee and Buckland Common Farmland LCA has a medium level of tranquillity, is of national level value, is in good condition and is considered to be of high sensitivity to change.
- 5.1.233 The following viewpoints are located in close proximity to the amendment and are described in the main ES (Volume 2, CFA9, Section 9):
- Viewpoint 083.4.001: view north-west from Mop End Lane across the A413 Amersham Road;
 - Viewpoint 083.2.002: view east from Parkview Cottages along the A413 Amersham Road;
 - Viewpoint 083.3.003: view north-east from PRoW (Footpath LMI/22/1), South Bucks Way, east of Little Missenden;
 - Viewpoint 084.3.001: view south from PRoW (Footpath LMI/40/2) towards the A413 Amersham Road;
 - Viewpoint 086.2.001: view west from Bullbaiters Lane and Bridleway LM/27/1 towards Mantle’s Wood;
 - Viewpoint 087.2.001: view north-east from Hyde Lane and adjacent residential properties;
 - Viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties;
 - Viewpoint 087.3.003: view north from Footpath LMI/21;
 - Viewpoint 088.2.001: view south from Hyde Heath Road and residential properties on Chesham Road;
 - Viewpoint 088.4.002: view south-west from Hyde Heath Road;
 - Viewpoint 088.2.004: view south-east from PRoW (Footpath GMI/23/6) and residential property The Hyde;
 - Viewpoint 088.4.003: view south-west from Hyde Heath Road;

- Viewpoint 089.3.003: view north from PRoW (Footpath GMI/33/5);
- Viewpoint 089.2.004: view north-east from Cudsden's Court residential properties;
- Viewpoint 090.2.001: view south-west from the B485 Chesham Road and associated residential properties;
- Viewpoint 090.3.002: view south-west from PRoW (Footpath GMI/23/5);
- Viewpoint 091.3.001: view north-east from PRoW (Footpath GMI/13/3);
- Viewpoint 091.3.002: view north-east from PRoW (Footpath GMI/12/1);
- Viewpoint 092.2.001: view south-west from Frith Hill including associated residential properties;
- Viewpoint 092.3.003: view south-west from PRoW (Footpath GMI/13/3);
- Viewpoint 093.3.001: view north-east from PRoW (Footpath GMI/12/1);
- Viewpoint 094.2.001: view south-west from PRoW (Footpath GMI/2/10 and residential properties on Potter Row);
- Viewpoint 094.2.002: view south-west from residential properties on Potter Row; and
- Viewpoint 094.4.003: view west along Leather Lane.

5.1.234 Three new viewpoints have also been assessed. These are:

- Viewpoint AP4.091.2.003: view north-east from Bury Field House;
- Viewpoint AP4.091.7.004: view north from the tennis courts and play area south of the A413; and
- Viewpoint AP4.091.4.005: view north-east from Station Approach, Great Missenden.

5.1.235 Viewpoint AP4.091.2.003: view north-east from Bury Field House is described in Volume 5: Appendix LV-001-009 and shown on map LV-03-034 of the SES3 and AP4 ES. The house is surrounded by a substantial boundary hedge, which screens views north-east of the A413 and the fields and hedges on the rising ground of the Misbourne valley beyond, from ground level in summer. The A413 and the valley side are likely to be visible from ground level in filtered views in the winter and in clear views from upstairs windows year round. Long views are limited by woodland blocks (including Stockings Wood) on the valley slopes.

5.1.236 Viewpoint AP4.091.7.004: view north from the tennis courts and play area south of the A413) and viewpoint AP4.091.4.005: view north-east from Station Approach, Great Missenden were found to be not significantly affected by the amendment, and are described in Volume 5: Appendix LV-001-009 and shown on map LV-03-034 of the SES3 and AP4 ES.

Future baseline

Construction (2017)

- 5.1.237 Volume 5: Appendix CT-004-000 of the SES3 and AP4 ES provides details of the committed developments which are assumed to have been implemented by 2017, additional to those identified in the main ES (Volume 5: Appendix CT-004-000) and SES and AP2 ES.
- 5.1.238 None of the identified developments affect the assessment of the AP4 amendment's likely construction impacts on landscape and visual.

Operation (2026)

- 5.1.239 Volume 5: Appendix CT-004-000 of the SES3 and AP4 ES provides details of the committed developments which are assumed to have been implemented by 2017, additional to those identified in the main ES (Volume 5: Appendix CT-004-000) in the SES and AP2 ES.
- 5.1.240 None of the identified developments affect the assessment of the AP4 amendment's likely operational impacts on landscape and visual.

Effects arising during construction

Landscape assessment

- 5.1.241 The main ES reported a significant major adverse effect on the Misbourne Upper North LCA as a result of the: construction of the Little Missenden ventilation shaft, the Chiltern tunnel north portal and deep cutting; removal of approximately 6.5ha of ancient woodland from Mantle's Wood and 3.5ha from Farthing's Wood and Hedgemoor Wood; and the removal of field hedgerows, resulting in the introduction of new features within the rural setting and the disruption of field patterns, altering key characteristics of the landscape.
- 5.1.242 The deepening of the Little Missenden ventilation shaft will not enlarge the area affected by the construction works for the shaft or change the nature of the effects reported in the main ES. The extension of the Chiltern tunnel and the relocation of the tunnel north portal 2.6km to the north-west will however substantially reduce the scale of the works taking place in the LCA. The tunnel will now pass under Mantle's Wood, Farthing's Wood and Hedgemoor Wood and they will therefore be unaffected during construction. Intervening woodland and hedgerows will contain the effects of the construction of the Chesham Road ventilation shaft, in the neighbouring Hyde Heath North LCA, which will be largely inconspicuous in the LCA.
- 5.1.243 The amendment will give rise to a different significant effect. This will change the level of significance of the effects on the Misbourne Upper North LCA reported in the main ES from major adverse to moderate adverse which remains significant.
- 5.1.244 The main ES reported a major adverse significant effect on the Hyde Heath North LCA during construction due to: the construction of a 23m deep cutting, the Hyde Lane overbridge and the Footpath GMI/27 overbridge; the realignment of the B485 Chesham Road; the removal of 2.3ha of Sibley's Coppice and hedgerows; the demolition of properties; and the presence of material stockpiles and construction compounds. These would alter key characteristics of the landscape.

- 5.1.245 The extension of the Chiltern tunnel will substantially reduce the scale of the works taking place in the Hyde Heath North LCA. The tunnel will now pass under Sibley's Coppice, which will therefore be unaffected during construction, and the realignment of the B485 Chesham Road and the Hyde Lane and the Footpath GMI/27 overbridges are no longer required for the amendment. The construction of the Chesham Road ventilation shaft will introduce new features into the landscape in the form of cranes and other machinery and a construction compound, but intervening woodland and hedgerows will contain the effects of the construction of the Chesham Road ventilation shaft to a small area of the LCA. Intervening woodland and hedgerows will contain the effects of the construction of the Chesham Road ventilation shaft, which will be largely inconspicuous in the LCA from the neighbouring LCA.
- 5.1.246 The amendment will give rise to a different significant effect during construction. This will reduce the level of significance of the effects on the Hyde Heath North LCA reported in the main ES and the SES and AP2 ES from major adverse to moderate adverse, which remains significant.
- 5.1.247 The main ES reported a major adverse significant effect on the Lee and Buckland Common Farmland LCA during construction due to the following activities: the construction of part of the South Heath green tunnel, the Chiltern tunnel north cutting, the South Heath green tunnel north portal and associated buildings and the Leather Lane and Footpath GMI/2 accommodation overbridges, altering key characteristics of the landscape.
- 5.1.248 The revised Chiltern tunnel north portal cutting will be longer, wider and deeper than the South Heath green tunnel portal cutting. The works will therefore have a larger footprint and be located closer to Frith Hill and Jenkin's Wood. Temporary material stockpiles will be relocated along a new Chiltern tunnel north portal access road between the A413 and the revised portal location. A satellite compound for the portal works will be relocated to the south of the new portal location and a new satellite compound will be located north of the A413 on the new access road. Two towers on the route of the existing 400kV overhead electricity line west of the Chiltern tunnel north portal will be replaced by a single, taller tower.
- 5.1.249 The construction works will affect a wider area within this LCA than was affected by the SES3 scheme, but the works will be of a similar nature.
- 5.1.250 The amendment will give rise to a different significant effect due to the construction works affecting a wider area but this will not change the level of significance of the effects reported in the main ES.

Visual assessment

Little Missenden ventilation shaft

- 5.1.251 The main ES reported significant effects on a number of visual receptors due to the presence of a roadhead, earthworks, material stockpiles, construction plant and the construction compound associated with the Little Missenden ventilation shaft and auto-transformer station. The following receptors were assessed as being affected by the SES3 scheme and will also be affected by this amendment (the significance of effects reported in the main ES is given in brackets):
- Viewpoint 083.4.001: view north-west from Mop End Lane across the A413

Amersham Road (moderate adverse);

- Viewpoint 083.2.002: view east from Parkview Cottages along the A413 Amersham Road (moderate adverse);
- Viewpoint 083.3.003: view north-east from PRow (Footpath LMI/22/1), South Bucks Way east of Little Missenden (moderate adverse); and
- Viewpoint 084.3.001: view south from PRow (Footpath LMI/40/2) towards the A413 Amersham Road (major adverse).

5.1.252 The deepening of the Little Missenden ventilation shaft will not enlarge the area affected by the construction works or change the nature of construction activities. The difference between the SES₃ scheme and the amendment will be barely perceptible in these views and therefore will not give rise to a new or different significant effect and will not change the level of significance of the effects reported in the main ES.

The Chiltern tunnel north portal (main ES location)

5.1.253 The main ES reported significant effects on a number of visual receptors due to the: construction of the cutting, the Chiltern tunnel north portal, the Hyde Lane and Footpath GMI/27 accommodation overbridges, removal of woodland from Mantle's Wood, Farthing's Wood and Hedgemoor Wood, and the realignment of the B485 Chesham Road. The following receptors were assessed as being affected by the SES₃ scheme and will also be affected by this amendment (the significance of effects reported in the main ES is given in brackets):

- Viewpoint 086.2.001: view west from Bullbaiters Lane and Bridleway LM/27/1 towards Mantle's Wood (major adverse);
- Viewpoint 087.2.001: view north-east from Hyde Lane and adjacent residential properties (moderate adverse);
- Viewpoint 087.3.003: view north from Footpath LMI/21 (major adverse);
- Viewpoint 088.2.001: view south from Hyde Heath Road and residential properties on the B485 Chesham Road (moderate adverse);
- Viewpoint 088.4.002: view south-west from Hyde Heath Road (moderate adverse);
- Viewpoint 088.2.004: view south-east from PRow (Footpath GMI/23/6) and residential property The Hyde (major adverse); and
- Viewpoint 088.4.003: view south-west from Hyde Heath Road (moderate adverse).

5.1.254 The extension of the Chiltern tunnel and the relocation of the tunnel north portal 2.6km to the north-west will substantially reduce the scale of the works visible from these locations. Cranes associated with the Chesham Road ventilation shaft may be visible in distant views above the intervening woodland. The amendment will give rise to different effects at these viewpoints, and this will reduce the level of significance of the effects reported in the main ES from major or moderate adverse to minor adverse, which is non-significant.

Chesham Road ventilation shaft

5.1.255 The main ES reported significant effects on a number of visual receptors due to the: construction of the cutting; the demolition of properties on Hyde Lane; the realignment of the B485 Chesham Road; the removal of field boundary vegetation; the presence of material stockpiles; and the construction of the Hyde Lane and Footpath GMI/27 accommodation overbridges. The following receptors were assessed as being affected by the SES3 scheme and will also be affected by this amendment (the significance of the effects reported in the main ES is given in brackets):

- Viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties (major adverse);
- Viewpoint 089.3.003: view north from PRoW (Footpath GMI/33/5) (major adverse);
- Viewpoint 089.2.004: view north-east from Cudsden's Court residential properties (major adverse);
- Viewpoint 090.2.001: view south-west from the B485 Chesham Road and associated residential properties (major adverse); and
- Viewpoint 090.3.002: view south-west from PRoW (Footpath GMI/23/5) (major adverse).

5.1.256 The removal of the cutting, demolitions, overbridges and the realignment of the road will substantially reduce the scale of the works in comparison to those of the SES3 scheme. The presence of a construction compound and activity on the Chesham Road ventilation shaft will, however, result in changes taking place within a relatively short distance from these receptors. The amendment will give rise to a different significant effect and this will reduce the level of significance of the effects reported in the main ES from major adverse to moderate adverse.

Chiltern tunnel north portal (AP4 revised scheme location)

5.1.257 The main ES reported significant effects on a number of visual receptors due to the: construction of the South Heath green tunnel; the tunnel portal and the Footpath GMI/12 and Footpath GMI/2 accommodation overbridges; the realignment of Leather Lane; and the presence of material stockpiles and construction compounds. The following receptors were assessed as being affected by the SES3 scheme and will also be affected by this amendment (the significance of the effects reported in the main ES is given in brackets):

- Viewpoint 091.3.002: view north-east from PRoW (Footpath GMI/12/1) (major adverse);
- Viewpoint 091.3.001: view north-east from PRoW (Footpath GMI/13/3) (major adverse);
- Viewpoint 092.2.001: view south-west from Frith Hill including associated residential properties (major adverse);
- Viewpoint 092.3.003: view south-west from PRoW (Footpath GMI/13/3) (major

adverse);

- Viewpoint 093.3.001: view north-east from PRoW (Footpath GMI/12/1) (major adverse);
- Viewpoint 094.2.001: view south-west from PRoW (Footpath GMI/2/10 and residential properties on Potter Row (major adverse); and
- Viewpoint 094.2.002: view south-west from residential properties on Potter Row (major adverse).

5.1.258 The replacement of the South Heath green tunnel with a bored tunnel will remove the requirement for large scale earthworks east of Frith Hill, but the relocated Chiltern tunnel north portal will increase the scale of the earthworks required immediately west of Frith Hill for the construction of the deeper cutting. The construction works extend beyond the construction boundary of the SES3 scheme. A construction compound will replace a material stockpile close to the portal and there will be two more material stockpiles along a new access road from the A413. A new construction compound will be located adjacent to this road and the A413. The existing 400kV overhead electricity line west of the portal will be diverted south and two existing pylons will be replaced by a taller pylon in this location. The amendment will give rise to a different significant effects on these receptors due to the introduction of new features in the view but this will not change the level of significance reported in the main ES.

Viewpoint AP4.091.2.003: view north-east from Bury Field House

5.1.259 The Chiltern tunnel north portal access road satellite compound, the temporary material stockpiles and the access road to the Chiltern tunnel north portal satellite compound will be located north-east of Bury Field House. Hoardings 2.4m high around the Chiltern tunnel north portal access road satellite compound will screen construction activity in the compound from ground level, but the temporary material stockpiles and the access road will be new features in the view from upper floor windows. The access road will be screened from view once it passes north-east of Stockings Wood. The powerline diversion works will be largely screened from view by Stockings Wood. The magnitude of change will be medium which, combined with the high sensitivity of the receptor, will result in a new visual effect of moderate adverse significance.

Mitigation and residual effects

5.1.260 Material arising from the excavation of the South Heath Cutting will be used to create a landscape earthworks bund along the western side of the new access road to screen it from the south-west. The access road will be in cutting for most of its length which will further screen it from view.

5.1.261 During construction, the amendment will generate a different significant effect on the Misbourne Upper North LCA and the Hyde Heath North LCA, reducing the effect from major adverse to moderate adverse.

5.1.262 During construction, the amendment will generate a different significant effect on the Lee and Buckland Common Farmland LCA but will not change the level of significance of the effect reported in the main ES.

- 5.1.263 The extension of the Chiltern tunnel, the relocation of the Chiltern tunnel north portal and the construction of the Chesham Road ventilation shaft will result in significant effects no longer arising on:
- Viewpoint 086.2.001: view west from Bullbaiters Lane and Bridleway LM/27/1 towards Mantle's Wood;
 - Viewpoint 087.2.001: view north-east from Hyde Lane and adjacent residential properties;
 - Viewpoint 087.3.003: view north from Footpath LMI/21;
 - Viewpoint 088.2.001: view south from Hyde Heath Road and residential properties on the B485 Chesham Road;
 - Viewpoint 088.4.002: view south-west from Hyde Heath Road;
 - Viewpoint 088.2.004: view south-east from PRoW (Footpath GMI/23/6) and residential property The Hyde; and
 - Viewpoint 088.4.003: view south-west from Hyde Heath Road.
- 5.1.264 The extension of the Chiltern tunnel, the relocation of the Chiltern tunnel north portal and the construction of the Chesham Road ventilation shaft will generate different residual significant effects. The significant effects will be reduced from major adverse to moderate adverse on the following viewpoints:
- Viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties;
 - Viewpoint 089.3.003: view north from PRoW (Footpath GMI/33/5);
 - Viewpoint 089.2.004: view north-east from Cudsden's Court residential properties;
 - Viewpoint 090.2.001: view south-west from the B485 Chesham Road and associated residential properties; and
 - Viewpoint 090.3.002: view south-west from PRoW (Footpath GMI/23/5).
- 5.1.265 The extension of the Chiltern tunnel, the relocation of the Chiltern tunnel north portal and the construction of the Chesham Road ventilation shaft will generate different residual significant effects but will not change the level of significance of the effect reported in the main ES on the following viewpoints:
- Viewpoint 091.3.002: view north-east from PRoW (Footpath GMI/12/1);
 - Viewpoint 091.3.001: view north-east from PRoW (Footpath GMI/13/3);
 - Viewpoint 092.2.001: view south-west from Frith Hill including associated residential properties;
 - Viewpoint 092.3.003: view south-west from PRoW (Footpath GMI/13/3);
 - Viewpoint 093.3.001: view north-east from PRoW (Footpath GMI/12/1);

- Viewpoint 094.2.001: view south-west from PRoW (Footpath GMI/2/10) and residential properties on Potter Row; and
- Viewpoint 094.2.002: view south-west from residential properties on Potter Row.

5.1.266 The Chiltern tunnel north portal access road satellite compound will give rise to a new moderate adverse residual significant effect on a new receptor, Viewpoint AP4.091.2.003: view north-east from Bury Field House.

5.1.267 All other significant residual construction effects remain as reported in the main ES.

Effects arising from operation

Landscape assessment

5.1.268 The main ES reported a moderate adverse significant effect on the Misbourne Upper North LCA during year 1 of operation, reducing to non-significant in years 15 and 60 when mitigation planting has established and integrated the new structures into the landscape. The effects were due to the introduction of new features into the landscape including the Little Missenden ventilation shaft headhouse, the auto-transformer feeder station, the Chiltern tunnel north portal and associated earthworks, the loss of ancient woodland and the reduction in tranquillity resulting from operation of the railway.

5.1.269 The deepening of the Little Missenden ventilation shaft will not affect the landscape outside of the structure. The extension of the Chiltern tunnel and the relocation of the tunnel north portal 2.6km to the north-west will substantially reduce the impacts of the scheme assessed in the main ES. The tunnel will pass under Mantle's Wood, Farthing's Wood and Hedgemoor Wood and they will therefore be unaffected by the scheme.

5.1.270 The amendment will give rise to a different effect. This will change the level of significance of the effect on the Misbourne Upper North LCA reported in the main ES and the SES and AP2 ES. The effect will be changed from moderate adverse which is significant to minor adverse which is non-significant in year 1 and years 15 and 60.

5.1.271 The main ES reported a moderate adverse significant effect on the Hyde Heath North LCA during year 1 of operation, reducing to non-significant in years 15 and 60 when mitigation planting has established and integrated the new structures into the landscape. The effects were due to the introduction of new features into the landscape, including the 23m deep cutting, Hyde Lane and Footpath GMI/27 accommodation overbridges, South Heath green tunnel, and the loss of ancient woodland from Sibley's Coppice.

5.1.272 The tunnel will now pass under Sibley's Coppice, which will therefore be unaffected during operation and Hyde Lane and the Footpath GMI/27 overbridges will no longer form part of the scheme. The Chesham Road ventilation shaft will be a new feature in the landscape but surrounding woodland and hedgerows will minimise the effects of the structure to a small area of the LCA. Intervening woodland and hedgerows will largely enclose the Chesham Road ventilation shaft and it will be largely inconspicuous in the neighbouring LCA.

- 5.1.273 The amendment will give rise to a different effect. This will change the level of significance of the effect on the Hyde Heath North LCA reported in the main ES and SES and AP2 ES. The effect will be changed from moderate adverse which is significant to minor adverse which is non-significant in year 1 and years 15 and 60.
- 5.1.274 The main ES reported a moderate adverse significant effect on the Lee and Buckland Common Farmland LCA during operation, reducing to non-significant in years 15 and 60 when mitigation planting has established and integrated the new structures into the landscape. The effects were due to the introduction of new features into the landscape, including the Footpath GMI/12 and Footpath GM/2 accommodation overbridges, the Leather Lane overbridge and the South Heath green tunnel and associated portal.
- 5.1.275 The Chiltern tunnel north portal will replace the South Heath green tunnel portal, but it will be wider and deeper than the green tunnel portal. The cutting will be closer to Frith Hill and the southern boundary of Jenkin’s Wood, but will not result in any direct loss of woodland. Landscape earthworks with planting around the eastern end of the portal and planting south of the route will limit the impacts of the scheme on the wider landscape and restore fragmented woodlands. The addition of 3m high noise fence barriers at the top of the cutting will be integrated with and screened by the adjacent 2m high landscape earthworks and associated landscape mitigation planting. The diversion of the 400kV overhead electricity line will result in the replacement of two existing towers (43m and 39m high) with one taller tower (55m high, but with the same footprint). The removal of one tower will reduce the existing detracting effect of the power line on the landscape, but the new tower may affect a wider area of the landscape than the two existing towers. However, it will be surrounded by existing woodland which will, combined with the undulating topography of the area, contain its effects over the wider landscape.
- 5.1.276 These new elements will introduce new features into the landscape. However, they will be located within the boundaries of the SES3 scheme and therefore within the context of the other prominent changes taking place in this location, they will not further affect the surrounding landscape. The north portal will occupy a larger footprint and the permanent access roads will extend further south and east than in the SES3 scheme in this location but the portal, the portal building and the cutting will be largely the same as those assessed in the main ES, although in a different location. The land affected by the Chiltern tunnel north portal temporary access road will be restored to its former agricultural use.
- 5.1.277 The amendment will give rise to a different significant effect in the Lee and Buckland Common Farmland LCA due to the change in the nature of the construction works, but will not change the level of significance of the effects reported in the main ES.

Visual assessment

Little Missenden ventilation shaft

- 5.1.278 The main ES reported a moderate adverse significant effect on viewpoint 084.3.001: view south from PRoW (Footpath LMI/40/2) towards the A413 Amersham Road during year 1 of operation, reducing to non-significant in years 15 and 60 when mitigation planting has established, due to the elevated views of the Little Missenden ventilation

shaft, headhouse, auto-transformer feeder station, hardstanding and associated planting and earthworks.

- 5.1.279 The deepening of the ventilation shaft as part of the amendment will not be visible from outside the structure but the elements of the SES₃ scheme will remain and consequently the amendment will not give rise to a new or different significant effect and will not change the level of significance of the effects reported in the main ES.

The Chiltern tunnel north portal (main ES location)

- 5.1.280 The main ES reported significant effects on a number of visual receptors due to the presence of the Chiltern tunnel north portal, the Hyde Lane and Footpath GMI/27 overbridges, the loss of woodland and the realignment of Chesham Road. The following receptors were assessed as being affected by the SES₃ scheme and will also be affected by this amendment (the significance of effects reported in the main ES is given in brackets):

- Viewpoint 086.2.001: view west from Bullbaiters Lane and Bridleway LM/27/1 towards Mantle’s Wood (moderate adverse in year 1, reducing to non-significant by years 15 and 60);
- Viewpoint 087.2.001: view north-east from Hyde Lane and adjacent residential properties (moderate adverse in year 1, reducing to non-significant by years 15 and 60);
- Viewpoint 087.3.003: view north from Footpath LMI/21 (major adverse in year 1, reducing to non-significant by years 15 and 60); and
- Viewpoint 088.2.001: view south from Hyde Heath Road and residential properties on Chesham Road (moderate adverse in year 1, reducing to non-significant by years 15 and 60).

- 5.1.281 The extension of the Chiltern tunnel and the relocation of the tunnel north portal 2.6km to the north-west will remove the need to fell parts of Mantle’s Wood, Farthing’s Wood and Hedgemoor Wood. In addition, the Hyde Lane and Footpath GMI/27 overbridges and the realignment of the B485 Chesham Road will be removed from the amendment. The Chesham Road ventilation shaft will be screened from view from these receptors by the existing vegetation. The amendment will change the level of significance of the effects reported in the main ES and SES and AP₂ ES on these receptors from major or moderate to negligible in year 1. In years 15 and 60 the effects remain non-significant as reported in the main ES and SES and AP₂ ES.

Chesham Road ventilation shaft

- 5.1.282 The main ES reported significant effects on a number of visual receptors due to the presence of the South Heath green tunnel, the cutting, access roads and the Hyde Lane overbridge. The following receptors (shown on map LV-04-003 in the Landscape and Visual Map Book in the SES₃ and AP₄ ES) were assessed as being affected by the SES₃ scheme and will also be affected by this amendment (the significance of effects reported in the main ES is given in brackets):

- Viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties (major adverse in year 1, reducing to non-significant by years 15 and

60);

- Viewpoint 089.3.003: view north from PRoW (Footpath GMI/33/5) (moderate adverse in year 1, reducing to non-significant by years 15 and 60);
- Viewpoint 089.2.004: view north-east from Cudsden's Court residential properties (moderate adverse in year 1, reducing to non-significant by years 15 and 60); and
- Viewpoint 090.2.001: view south-west from the B485 Chesham Road and associated residential properties (moderate adverse in year 1 reducing to non-significant by years 15 and 60).

5.1.283 As the South Heath green tunnel, the cutting, access roads and the Hyde Lane overbridge will no longer be constructed with the amendment in place, this will remove the most prominent elements of the SES3 scheme. The Chesham Road ventilation shaft and auto-transformer station will occupy a substantially smaller footprint than the SES3 scheme. It will however, be a new element in these views.

5.1.284 The amendment will generate a different significant effect on viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties due to the removal of the green tunnel, the cutting, access roads and the Hyde Lane overbridge from the SES3 scheme. The Chesham Road ventilation shaft and auto-transformer station will be new features in the view, but they will occupy a far smaller proportion of the view than that of the SES3 scheme. This will change the level of significance of the effect reported in the main ES from major to moderate adverse in year 1, becoming minor adverse in years 15 and 60 which is non-significant.

5.1.285 The amendment will generate a different significant effect on viewpoint 089.3.003: view north from PRoW (Footpath GMI/33/5), viewpoint 089.2.004: view north-east from Cudsden's Court residential properties and viewpoint 090.2.001: view south-west from the B485 Chesham Road and associated residential properties due to the removal of the green tunnel, the cutting, access roads and the Hyde Lane overbridge from the scheme. The Chesham Road ventilation shaft and auto-transformer station will be new features in the view, but they will occupy a far smaller proportion of the view than that of the SES3 scheme. The amendment will not change the level of significance of the effects reported in the main ES.

Chiltern tunnel north portal (AP4 revised scheme location)

5.1.286 The main ES reported significant effects on a number of visual receptors due to the presence of the South Heath green tunnel, the cutting, the tunnel portal and the Footpath GMI/12 and Footpath GMI/2 accommodation overbridges and the Leather Lane overbridge. The following receptors were assessed as being affected by the SES3 scheme and will also be affected by this amendment (the significance of effects reported in the main ES is given in brackets):

- Viewpoint 091.3.002: view north-east from PRoW (Footpath GMI/12/1) (moderate adverse in year 1, reducing to non-significant by years 15 and 60);
- Viewpoint 091.3.001: view north-east from PRoW (Footpath GMI/13/3) (moderate adverse in year 1, reducing to non-significant by years 15 and 60);

- Viewpoint 092.2.001: view south-west from Frith Hill including associated residential properties (moderate adverse in year 1, reducing to non-significant by years 15 and 60);
- Viewpoint 092.3.003: view south-west from PRoW (Footpath GMI/13/3) (moderate adverse in year 1, reducing to non-significant by years 15 and 60);
- Viewpoint 093.3.001: view north-east from PRoW (Footpath GMI/12/1) (moderate adverse in year 1, reducing to non-significant by years 15 and 60);
- Viewpoint 094.2.001: view south-west from PRoW (Footpath GMI/2/10) and residential properties on Potter Row (moderate adverse in year 1, reducing to non-significant by years 15 and 60);
- Viewpoint 094.2.002: view south-west from residential properties on Potter Row (moderate adverse in year 1, reducing to non-significant by years 15 and 60); and
- Viewpoint 094.4.003: view west along Leather Lane (moderate adverse in year 1, reducing to non-significant by years 15 and 60).

5.1.287 As the South Heath green tunnel, the cutting, access roads and the Hyde Lane overbridge will no longer be constructed with the amendment in place, this will remove the most prominent elements of the SES₃ scheme. The Chesham Road ventilation shaft and auto-transformer station will occupy a substantially smaller footprint than the SES₃ scheme. It will, however, be a new element in these views.

5.1.288 The amendment will generate a different significant effect on viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties due to the removal of the green tunnel, the cutting, access roads and the Hyde Lane overbridge from the SES₃ scheme. The Chesham Road ventilation shaft and auto-transformer station will be new features in the view, but they will occupy a far smaller proportion of the view than that of the SES₃ scheme. This will change the level of significance of the effect reported in the main ES from major to moderate adverse in year 1, becoming minor adverse in years 15 and 60 which is non-significant.

5.1.289 The amendment will generate a different significant effect due to the presence of Chiltern tunnel north portal, the new access roads, the proposed noise fence barriers and the diversion of the 400kV overhead electricity line, but this will not change the level of significance of the effects reported in the main ES. For all other viewpoints, the relocation of the Chiltern tunnel north portal will not give rise to a new or different significant effect and will not change the level of significance of the effects reported in the main ES.

Mitigation and residual effects

5.1.290 New landscape mitigation planting is proposed along the proposed noise fence barrier between Jenkin's Wood and Potter Row to screen views from viewpoints 094.2.002: view south-west from residential properties on Potter Row and 094.2.001: view south-west from PRoW (Footpath GMI/2/10) and residential properties on Potter Row.

5.1.291 During operation, the significant residual effect on the Misbourne Upper North LCA and the Hyde Heath North LCA will no longer arise as a result of the amendment. The

effect will be reduced from a major adverse significant effect to a minor adverse effect which is non-significant.

- 5.1.292 During operation, the amendment will generate a different significant effect on the Lee and Buckland Common Farmland LCA but will not change the significance of the effect reported in the main ES.
- 5.1.293 The extension of the Chiltern tunnel and the relocation of the tunnel north portal will result in residual significant effects no longer arising on viewpoint 086.2.001: view west from Bullbaiters Lane and Bridleway LM/27/1 towards Mantle's Wood, viewpoint 087.2.001: view north-east from Hyde Lane and adjacent residential properties, viewpoint 087.3.003: view north from Footpath LMI/21, and viewpoint 088.2.001: view south from Hyde Heath Road and residential properties on the B485 Chesham Road.
- 5.1.294 The extension of the Chiltern tunnel and the relocation of the Chiltern tunnel north portal will reduce the significant residual effect on viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties from major to moderate in year 1 of operation.
- 5.1.295 The extension of the Chiltern tunnel and the relocation of the Chiltern tunnel north portal will result in a different effect on viewpoints 089.3.003: view north from PRoW (Footpath GMI/33/5), viewpoint 089.2.004: view north-east from Cudsden's Court residential properties, and viewpoint 090.2.001: view south-west from the B485 Chesham Road and associated residential properties, viewpoint 091.3.002: view north-east from PRoW (Footpath GMI/12/1), viewpoint 091.3.001: view north-east from PRoW (Footpath GMI/13/3), viewpoint 092.2.001: view south-west from Frith Hill including associated residential properties; viewpoint 092.3.003: view south-west from PRoW (Footpath GMI/13/3), viewpoint 093.3.001: view north-east from PRoW (Footpath GMI/12/1), viewpoint 094.2.001: view south-west from PRoW (Footpath GMI/2/10) and residential properties on Potter Row; viewpoint 094.2.002: view south-west from residential properties on Potter Row, and viewpoint 094.4.003: view west along Leather Lane. However, this will not change the level of significance of the effects reported in the main ES.
- 5.1.296 All other significant residual operational effects remain as reported in the main ES.

Cumulative effects

- 5.1.297 There are no new or different likely significant cumulative effects for landscape and visual as a result of the AP4 amendments interacting with one another, the AP1 amendments, AP2 amendments or any relevant committed developments.

Socio-economics

Introduction

- 5.1.298 This section of the report describes the environmental baseline in relation to socio-economics that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the amendment, compared to those of the SES3 scheme.

Scope, assumptions and limitations

- 5.1.299 The assessment scope, key assumptions and limitations for socio-economics are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001 -000) and the SMR Addendum (Volume 5: Appendix CT-001-000) of the main ES.

Existing baseline

- 5.1.300 The baseline socio-economics information for CFA9 is described in the main ES (Volume 2, CFA9, Section 10).

Future baseline

Construction (2017)

- 5.1.301 Volume 5: Appendix CT-004-000 of the SES3 and AP4 ES provides details of the committed developments which are assumed to have been implemented by 2017, additional to those identified in the main ES and the SES and AP2 ES.
- 5.1.302 None of the identified developments affect the assessment of the AP4 amendment's likely construction impacts on socio-economics.

Operation (2026)

- 5.1.303 Volume 5: Appendix CT-004-000 of the SES3 and AP4 ES provides details of the developments which are assumed to have been implemented by 2026, additional to those identified in the main ES and the SES and AP2 ES.
- 5.1.304 None of the identified developments affect the assessment of the amendment's likely operational impacts on socio-economics.

Effects arising during construction

- 5.1.305 The amendment includes the alteration of land required as a result of the extension of the Chiltern tunnel by 2.6km. This amendment will result in the retention of the Weights and Measures gym and The Workshop, Elwis Field Farm on Frith Hill which were reported to be demolished in the main ES.
- 5.1.306 No significant construction socio-economic effects were reported in the main ES (Volume 2, CFA9, Section 10) and there are no changes to this assessment arising from this amendment.
- 5.1.307 It is estimated that the extension of the Chiltern tunnel would result in the retention of a total of five jobs in this area.

Effects arising during operation

- 5.1.308 No significant operational socio-economic effects were reported in the main ES (Volume 2, CFA9, Section 10) and there are no changes to this assessment arising from this amendment.

Mitigation and residual effects

- 5.1.309 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.

- 5.1.310 No significant residual effects of relevance to this amendment were reported in the main ES and there are no changes to this assessment arising from this amendment.

Cumulative effects

- 5.1.311 There are no new or different likely significant cumulative effects for socio-economics as a result of the AP₄ amendments interacting with one another, the AP₁ amendments, AP₂ amendments or any relevant committed developments.

Sound, noise and vibration

Introduction

- 5.1.312 This section of the report describes the environmental baseline in relation to sound, noise and vibration that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the amendment, compared to those of the SES₃ scheme.

Scope, assumptions and limitations

- 5.1.313 The assessment scope, key assumptions and limitations for sound, noise and vibration are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2) of the main ES.
- 5.1.314 Local assumptions and limitations for sound, noise and vibration are set out in the main ES, Volume 2, CFA₉, Section 11.

Existing baseline

- 5.1.315 The baseline sound, noise and vibration information for CFA₉ is described in the main ES (Volume 2, CFA₉, Section 11.2). Baseline sound levels representative of the assessment locations affected by this amendment have been used in the construction and operational sound, noise and vibration assessments.
- 5.1.316 Additionally, the assessment of construction and operational sound, noise and vibration for the Chiltern tunnel extension involves assessment of new locations in addition to those previously assessed in the main ES. This is due to some buildings that were expected to be demolished in the SES₃ scheme no longer being demolished.
- 5.1.317 Table 6 sets out residential receptors in addition to those reported in the main ES, Volume 5: Appendix SV-002-009. An explanation of the information within this table is provided in the main ES, Volume 5: Appendix SV-002-013.

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Table 6: Existing baseline sound levels

ID	Area represented	Measurement location	Existing baseline sound level (dB)							Data source coding ¹¹
			For operational sound assessment				For construction sound assessment			
			Daytime L _{pAeq, 16hr}	Night-time L _{pAeq, 8hr}	Arithmetic average of night-time L _{pAFmax, 5min}	Highest night-time L _{pAFmax, 5min}	Daytime L _{pAeq}	Evening/Weekend L _{pAeq}	Night-time L _{pAeq}	
374719	Frith Hill, South Heath	CS2050	64.6	55.5	63.3	89.6	65.1	63.3	55.3	3,A,ii,b
376474	Chesham Road, Hyde End	CS2023	57.4	49.9	77.0	93.8	57.7	54.9	49.2	3,BC,ii,b
720451	Annie Bailey's public house and dwelling	CS8050	59.2	52.5	76.2	89.3	59.5	58.8	51.7	3,BC,ii,b

Future baseline

Construction (2017)

- 5.1.318 With the exception of the addition of baseline sound levels (detailed in Table 6) for the new assessment locations, the future baseline for construction in 2017, and construction traffic in 2021, remains unchanged from that reported in the main ES (Volume 2, CFA9, Section 11.2) and SES and AP2 ES.
- 5.1.319 SES3 and AP4 ES, Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2017, additional to those identified in the main ES (Volume 5: Appendix CT-004-000).
- 5.1.320 None of the identified developments affect the assessment of the AP4 amendment's likely construction noise and vibration impacts.

Operation (2026)

- 5.1.321 With the exception of the addition of baseline sound levels (detailed in Table 6) for the new assessment locations, the future baseline for operation in 2026 remains unchanged from that reported in the main ES (Volume 2, CFA9, Section 11.2) and the SES and AP2 ES.
- 5.1.322 SES3 and AP4 ES, Volume 5: Appendix CT-004-000 provides details of the developments which are assumed to have been implemented by 2026, additional to those identified in the main ES (Volume 5: Appendix CT-004-000).

¹¹ The data source coding identifies how the baseline sound levels allocated to each assessment location have been derived. This coding is summarised in Table 2 of main ES, Volume 5: Appendix SV002-009 and explained in detail in Annex B of main ES, Volume 5: Appendix SV-001-000.

- 5.1.323 None of the identified developments affect the assessment of the AP4 amendment's likely operational noise and vibration impacts.

Effects arising during construction

- 5.1.324 Within CFA9, the design changes introduced by the AP4 amendment will lead to additional works associated with the construction of the Chesham Road ventilation shaft, the amended Chiltern tunnel north portal just west of Frith Hill, the Chiltern tunnel north portal access road and the satellite compound located south of the portal next to the A413 Missenden bypass/A4128 Link Road roundabout. The amendment will also lead to a reduction in the amount of construction traffic on local roads compared to the main ES because the work associated with the cutting and green tunnel construction will no longer occur.
- 5.1.325 An assessment has been undertaken to determine whether construction noise and vibration associated with the amendment would result in a new or different likely significant effect, using the significance criteria detailed in the main ES (Volume 5: Appendix SV-001-000).

Residential receptors: direct effects - individual dwellings

- 5.1.326 In the main ES, two residential buildings (a dwelling on King's Lane and a dwelling on the B485 Chesham Road) were forecast to experience noise levels higher than noise insulation trigger levels during construction.
- 5.1.327 Due to the amendment removing works associated with the South Heath green tunnel, these two dwellings are no longer forecast to experience noise levels higher than noise insulation trigger levels during construction.
- 5.1.328 No further dwellings are forecast to experience noise levels higher than noise insulation trigger levels during construction as a result of the amendment.

Residential receptors: direct effects – communities

- 5.1.329 In the main ES, direct adverse effects on residential communities and shared open areas that are considered significant on a community basis were identified in South Heath at approximately 50 dwellings on Sibleys Rise, Bayleys Hatch and Frith Hill (CSV09-Co1)²² due to construction works associated with the South Heath green tunnel. Due to the amendment, removing works associated with the South Heath green tunnel, this significant adverse noise effect is no longer likely to occur.
- 5.1.330 No new or different significant construction noise effects on residential communities have been identified as a result of the amendment.

Non-residential receptors: direct effects

- 5.1.331 In the main ES, no likely significant construction noise or vibration effects on non-residential receptors were identified in this area.
- 5.1.332 The amendment will not give rise to a new or different significant effect on non-residential receptors in comparison with those reported in the main ES.

²² Construction noise effects considered significant when assessed on a community basis are identified with a unique identification number, CSVXX-CXX. Further detail on these effects can be found in Volume 5, Appendix SV-003-009 of the main ES.

Residential and non-residential receptors: indirect effects

- 5.1.333 In the main ES, a likely significant indirect noise effect was reported on residential receptors located immediately adjacent to King's Lane (south of Frith Hill) where it passes through South Heath (significant effect number CSV₀₉-Co₂) caused by construction traffic. As a result of the amendment, this significant indirect noise effect is no longer likely.
- 5.1.334 No new or different significant indirect noise effects on residential and non-residential receptors have been identified as a result of the amendment.
- 5.1.335 The predicted construction sound levels as a result of this amendment in CFA₉ are presented in the SES₃ and AP₄ ES, Volume 5: Appendix SV-003-009.

Effects arising from operation

- 5.1.336 The main ES identified one dwelling that was estimated to be likely to qualify for noise insulation as described in the avoidance and mitigation measures section in the main ES (Volume 2, CFA₉, Section 11.5). The dwelling, Sheepcotts Cottage on Hyde Lane, is shown as OSV₀₉-Do₁¹³ in the main ES, Volume 5 Appendix SV-004-009 and shown in the main ES, Map Series SV-01, SV-02 and SV-05. The mitigation measures described in the main ES, including noise insulation, would reduce noise inside this dwelling such that it does not reach a level where it would significantly affect residents.
- 5.1.337 The main ES identified significant effects on a community basis at Hyde End, reference OSV₀₉-Co₁¹⁴ and South Heath, reference OSV₀₉-Co₂, as identified in the main ES, Volume 5, Appendix Sv-004-009.
- 5.1.338 An assessment has been undertaken to determine whether operational noise levels from the amendment would result in a likely significant effect, using the significance criteria detailed in the main ES (Volume 5: Appendix SV-001-000). The predicted operational sound and vibration levels as a result of this amendment are presented in the SES₃ and AP₄ ES, Volume 5, Appendix SV-004-009.
- 5.1.339 The property at Sheepcotts Cottage was identified in the main ES as a likely noise insulation qualifier. As a result of the amendment, this property is now outside the operational airborne noise study area and hence below the lowest observed adverse effect level. Consequently, Sheepcotts Cottage is no longer estimated to be likely to qualify for noise insulation from operational noise.
- 5.1.340 The community at Hyde End identified in the main ES as likely to experience a significant airborne noise effect is, as a result of this amendment, now outside the operational airborne noise study area and hence below the lowest observed adverse effect level. Therefore, the amendment reduces operational sound levels such that no adverse effects are identified at the community around Hyde Lane removing the likely significant effect (OSV₀₉-Co₁) identified in the main ES.

¹³ Individual dwellings that are forecast to experience a significant adverse noise effect during operation are identified with a unique identification number, OSVXX-DXX. These properties are estimated as being likely to qualify for noise insulation. Further detail can be found in Volume 5, Appendix SV-004-009 of the main ES.

¹⁴ Operational noise effects that are considered significant when assessed on a community basis are identified with a unique identification number, OSVXX-CXX. Further detail on these effects can be found in Volume 5, Appendix SV-004-009 in the main ES.

- 5.1.341 The mitigation envisaged with the amendment reduces operational sound levels such that the adverse effects on the residential area around South Heath, Potters Row (reported in the main ES as significant effect number OSV09-Co2) are no longer considered significant when assessed on a community basis.
- 5.1.342 A number of properties that were expected to be demolished in the SES3 scheme for the construction of the South Heath green tunnel will no longer be demolished as a result of the amendment. All assessment locations are identified in SES3 and AP4 ES, Volume 5, Map Series SV-03 and SV-04. Predictions of airborne noise, groundborne noise and vibration have been made at these properties. The assessment indicates that none of these retained properties will be subject to an airborne noise, groundborne noise or vibration impact, and therefore no likely significant effects are identified. Refer to SES3 and AP4 ES, Volume 5, Appendix SV004-009 for details.

Mitigation and residual effects

Construction

- 5.1.343 The assessment of construction noise and vibration assumes the implementation of the principles and management processes set out in the draft CoCP (Volume 5: Appendix CT-003-000 of the main ES). No additional mitigation is considered necessary as a result of the proposed amendment.
- 5.1.344 As a result of the amendment, residual significant noise effects at the residential communities in South Heath along Sibleys Rise, Bayleys Hatch and Frith Hill and residual significant noise effects on residential receptors adjacent to King's Lane arising from construction traffic on King's Lane (south of Frith Hill), identified in the main ES are no longer likely to occur.
- 5.1.345 There are no further changes to the residual significant construction noise effects identified in the main ES as a result of this amendment.

Operation

- 5.1.346 The amendment includes the provision for operational noise mitigation in the form of noise fence barriers which are approximately 3m high and 1.4km long at the top of the South Heath cutting on the eastern side of the route, extending from the new portal to Leather Lane (in CFA9). The barriers will be integrated with the landscape earthworks and landscape planting. An alternative 6m high barrier at the bottom of the cutting may also provide the level of attenuation required and could be substituted for the 3m barrier now proposed however, further design development is required before this can be confirmed. This proposed mitigation is in addition to the mitigation identified within the main ES (Volume 2, CFA9, Section 11).
- 5.1.347 The significant residual operational noise effects identified in the main ES near Hyde Lane (significant effect number OSV09-Co1) and South Heath, Potters Row (significant effect number OSV09-Co2) are no longer likely as a result of the amendment. Otherwise, the likely residual significant effects are as described in the main ES.

Cumulative effects

- 5.1.348 There are no new or different likely significant cumulative effects for sound, noise and vibration as a result of the AP4 amendments interacting with one another, the AP1 amendments, AP2 amendments or any relevant committed development.

Traffic and transport

Introduction

- 5.1.349 This section of the report describes the environmental baseline in relation to traffic and transport that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the amendment, compared to those of the SES3 scheme.

Scope, assumptions and limitations

- 5.1.350 The assessment scope, key assumptions and limitations for traffic and transport are as set out in Volume 1, the SMR (Volume 5: Appendix CT-010-000/1) and the SMR Addendum (Volume 5: Appendix CT-010-000/2) of the main ES.

Existing baseline

- 5.1.351 The existing baseline for traffic and transport is as set out in Volume 2, CFA9, Section 12 of the main ES, updated by additional traffic survey data.
- 5.1.352 Details of the survey data are included in SES3 and AP4 ES, Volume 5: Appendix TR-001-000.

Future baseline

Construction

- 5.1.353 The future baseline for construction is as set out in Volume 2, CFA9, Section 12 of the main ES, updated by the additional survey data.

Operation (2026 and 2041)

- 5.1.354 The future baselines for operation are as set out in Volume 2, CFA9, Section 12 of the main ES, updated by the additional survey data.

Effects arising during construction

- 5.1.355 Construction routes have been revised as a result of the amendment which has resulted in the removal of construction traffic from Potter Row, Frith Hill, King's Lane (between Frith Hill and the B485 Frith Hill/Chesham Road) and Hyde Heath Road. Construction traffic accessing Leather Lane overbridge satellite compound and Bowood Lane overbridge satellite compound, which previously used these roads, will now use the new A413 temporary access road to the Chiltern tunnel north portal satellite compound and internal compound haul roads.
- 5.1.356 The new A413 temporary access road has resulted in revised construction routes via the Chiltern tunnel north portal satellite compound. This enables approximately 50% of trips related to the movement of excavated material from Hunts Green Farm (previously all using Rocky Lane) to be routed via the A413 temporary access road, the A413 between the link road and the B4009 Nash Lee Road, and Nash Lee Road. The

remainder of this traffic will continue to use Rocky Lane, however, this revision to construction routes reduces impacts on Rocky Lane and the A413/Rocky Lane junction.

- 5.1.357 The amendment changes construction traffic flows, due to differences in trips generated by compounds within the area related to the Chiltern tunnel extension. The changes result in an increase in all construction vehicles (by up to 20 trips a day) on the A413 north of the B485 Frith Hill/Chesham Road and a decrease in all construction vehicles (by up to 75 trips as day) on the A413 south of the B485 Frith Hill/Chesham Road and the B4009 Nash Lee Road. There is also a decrease in all construction vehicles (by up to 10 trips a day) on the B485 Frith Hill/Chesham Road between the Chesham Road ventilation shaft satellite compound and the A413.
- 5.1.358 The amendment also results in the removal of temporary road closures of Hyde Lane and Frith Hill (and associated removal of traffic from diversion routes) and changes to temporary and permanent diversions of PRow.
- 5.1.359 The extension of the Chiltern tunnel has the potential to change the effects of HS2 construction traffic on the local network, with regard to congestion and delays to vehicle users, traffic related severance for non-motorised users, road closures and associated diversions, and travel distance for non-motorised users.
- 5.1.360 The revised assessment based upon existing and supplementary traffic data identifies new or different significant effects in relation to congestion and delays to vehicle users at the following junctions:
- A413/Leather Lane: increase in HGV traffic, resulting in a new major adverse significant effect (a non-significant impact reported in the SES and AP2 ES); and
 - A413 London Road/A4128 Link Road: introduction of a new A413 access road onto this junction and increase in HGV traffic, resulting in a major adverse significant effect (a major adverse effect reported in the main ES which was removed in the SES and AP2 ES).
- 5.1.361 The revised assessment based upon existing and supplementary traffic data identifies the removal of significant effects in relation to congestion and delays to vehicle users at the following junctions:
- B485 Frith Hill (Chesham Road)/Hyde Heath Road: decrease in construction traffic, resulting in the removal of the minor adverse significant effect reported in the SES and AP2 ES;
 - B485 Frith Hill (Chesham Road)/Kings Lane: decrease in construction traffic, resulting in the removal of the major adverse significant effect reported in the main ES; and
 - B485 Frith Hill (Chesham Road)/Frith Hill: decrease in construction traffic, resulting in the removal of the major adverse significant effect reported in the main ES.

- 5.1.362 The amendment will result in the removal of significant effects in relation to traffic related severance for non-motorised users at the following locations:
- Potter Row between Leather Lane and Frith Hill: removal of a moderate adverse significant effect reported in the main ES;
 - Frith Hill between Potter Row/King's Lane and B485 Frith Hill/Chesham Road: removal of a major adverse significant reported in the main ES;
 - King's Lane between Frith Hill and B485 Frith Hill/Chesham Road: removal of a major adverse significant effect reported in the main ES; and
 - Hyde Heath Road between B485 Frith Hill/Chesham Road and access to Chiltern tunnel north portal satellite compound: removal of a major adverse significant effect reported in the main ES.
- 5.1.363 The amendment will also result in different effects in relation to traffic related severance for non-motorised users at the following locations:
- A413 between Hyde Lane and B485 Frith Hill/Chesham Road: construction traffic reduced compared to the SES₃ scheme resulting in a moderate adverse significant effect (previously a major adverse significant effect was reported in Part 1 of the SES and AP₂ ES, reported under the description 'A413/A413 Amersham Bypass, between A355 Gore Hill and B485 Frith Hill'). Note that the A413 between A355 Gore Hill (in CFA₈) and Hyde Lane remains a major adverse effect;
 - A413 London Road between B485 Frith Hill/Chesham Road and Rocky Lane (in CFA₁₀): increase in HGV traffic compared to the SES₃ scheme resulting in a major adverse significant effect (previously a non-significant effect was reported in Part 1 of the SES and AP₂ ES). Note that this effect is also reported within CFA₁₀;
 - B485 Frith Hill/Chesham Road, between the A413 and King's Lane: decrease in construction traffic and removal of diverted traffic resulting in a moderate adverse significant effect (a major adverse effect reported in the SES and AP₂ ES); and
 - B485 Frith Hill/Chesham Road, between King's Lane and ventilation shaft S5 compound access: increase in HGV construction traffic resulting in a major adverse significant effect (a moderate adverse effect was reported in the SES and AP₂ ES).
- 5.1.364 The amendment will result in the removal of likely significant effects in relation to road closures and associated diversions (causing increased travel distance and time for traffic) at the following locations:
- Frith Hill between Potter Row/King's Lane and B485 Frith Hill/Chesham Road: major adverse effect reported in the main ES removed due to the removal of the temporary road closure; and
 - Hyde Lane: moderate adverse effect reported in the main ES removed due to the removal of the temporary road closure.

5.1.365 Significant effects reported in the main ES in relation to increased travel distance for non-motorised users will no longer arise at the following locations:

- Frith Hill (a minor adverse effect);
- Hyde Lane (a minor adverse effect);
- Footpath GMI/79/2 (a minor adverse effect);
- Footpath GMI/80/1 (a minor adverse effect);
- Footpath GMI/79/1 (a minor adverse effect);
- Footpath GMI/28/1 (a minor adverse effect);
- Footpath GMI/28/2 (a minor adverse effect);
- Footpath LMI/17/2 (a moderate adverse effect); and
- Footpath GMI/23/6 (a minor adverse effect).

5.1.366 The amendment will also give rise to new significant effects in relation to increased travel distance for non-motorised users at the following locations:

- Footpath GMI/33/4: a minor adverse effect; and
- Footpath GMI/13/3: a minor adverse effect (previously not significant in the SES₃ scheme).

Effects arising from operation

5.1.367 The extension of the Chiltern tunnel has the potential to change the effects of HS₂ during operation on the local network, with regard to travel distance for non-motorised users.

5.1.368 The amendment will result in the removal of permanent likely residual significant effects reported in the main ES in relation to increased travel distance for non-motorised users at the following locations:

- King's Lane (a minor adverse effect);
- B485 Chesham Road (a minor adverse effect);
- Footpath GMI/33/4 (a minor adverse effect);
- Footpath GMI/33/2 (a minor adverse effect);
- Footpath GMI/33/3 (a minor adverse effect);
- Footpath GMI/27/1 (a minor adverse effect);
- Footpath GMI/23/7 (a minor adverse effect); and
- Footpath LMI/21/1 (a minor adverse effect).

Mitigation and residual effects

- 5.1.369 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.
- 5.1.370 Significant adverse residual effects in relation to congestion and delays to vehicle users during construction will be removed at the junctions of: the B485 Frith Hill (Chesham Road)/Hyde Heath Road, the B485 Frith Hill (Chesham Road)/ Kings Lane; and the B485 Frith Hill (Chesham Road)/Frith Hill.
- 5.1.371 There are also new or different significant adverse residual effects during construction in relation to congestion and delays to vehicle users during construction. There is a new adverse significant residual effect at the A413/Leather Lane and the adverse residual effect at A413 London Road/A4128 Link Road is reintroduced.
- 5.1.372 Significant adverse residual effects in relation to traffic related severance for non-motorised users during construction will be removed at: Potter Row between Leather Lane and Frith Hill; Frith Hill between Potter Row/King's Lane and the B485 Frith Hill/Chesham Road; King's Lane between Frith Hill and B485 Frith Hill/Chesham Road; and Hyde Heath Road between the B485 Frith Hill/Chesham Road and access to Chiltern tunnel north portal satellite compound.
- 5.1.373 There are also new or different significant adverse residual effects during construction in relation to traffic related severance for non-motorised users. A new significant adverse residual effect in relation to traffic related severance will occur on the A413 London Road between the B485 Frith Hill/Chesham Road and Rocky Lane (in CFA10). On the B485 Frith Hill/Chesham Road, between King's Lane and the Chesham Road ventilation shaft satellite compound access, the significant adverse residual effects increase in the level of significance. On the A413 between Hyde Lane and the B485 Frith Hill/ Chesham Road and on the B485 Frith Hill/Chesham Road between the A413 and King's Lane, the significant adverse residual effects reduce in the level of significance.
- 5.1.374 Significant adverse residual effects in relation to road closures and associated diversions (causing increased travel distance and time for traffic) during construction will be removed at: Frith Hill between Potter Row/King's Lane and the B485 Frith Hill/Chesham Road; and Hyde Lane.
- 5.1.375 Significant adverse residual effects in relation to increased travel distance for non-motorised users during construction will no longer arise at the following locations: Frith Hill, Hyde Lane, Footpath GMI/79/2, Footpath GMI/80/1, Footpath GMI/79/1, Footpath GMI/28/1, Footpath GMI/28/2, Footpath LMI/17/2, and Footpath GMI/23/6.
- 5.1.376 New significant adverse residual effects in relation to increased travel distance for non-motorised users during construction will occur at the following locations: Footpath GMI/33/4; and Footpath GMI/13/3.
- 5.1.377 Permanent significant adverse residual effects in relation to increased travel distance for non-motorised users are removed at: King's Lane; the B485 Chesham Road; Footpath GMI/33/4; Footpath GMI/33/2; Footpath GMI/33/3; Footpath GMI/27/1; Footpath GMI/23/7; and Footpath LMI/21/1.

- 5.1.378 The significant effects that result from construction of the AP4 revised scheme are shown on Map TR-03-053 (SES3 and AP4 ES, Volume 5, Traffic and transport, CFA9 Map Book).
- 5.1.379 The significant effects that result from operation of the AP4 revised scheme in 2026 and 2041 are shown on Map TR-04-064 (SES3 and AP4 ES, Volume 5, Traffic and transport, CFA9 Map Book).

Cumulative effects

- 5.1.380 The above assessment has taken into account cumulative effects, including planned developments by taking account of background traffic growth, as well as traffic and transport impacts of works being undertaken in neighbouring areas.
- 5.1.381 There are no new or different likely significant cumulative effects for traffic and transport as a result of the AP4 amendments interacting with one another or the AP1 amendments or AP2 amendments.

Water resources and flood risk assessment

Introduction

- 5.1.382 This section of the report describes the environmental baseline in relation to water resources and flood risk that is relevant to the assessment. It then identifies any new or different likely significant environmental effects as a result of the amendment, compared to those of the SES3 scheme.

Scope, assumptions and limitations

- 5.1.383 The assessment scope, key assumptions and limitations for the water resources and flood risk assessment are as set out in Volume 1, the SMR (Volume 5: Appendix CT-001-000/1) and the SMR Addendum (Volume 5: Appendix CT-001-000/2) of the main ES.
- 5.1.384 This assessment considers the impact of construction and operation on existing public water supply (PWS) abstractions. However, the assessment does not consider the potential for impacts associated with the development of alternative groundwater sources, or changes to the abstraction regime at any of the existing PWS sites.

Existing baseline

- 5.1.385 A summary of the baseline information relevant to the assessment of the amendment is provided. For those receptors described in the main ES, further details are provided in the main ES, Volume 2, CFA9, Section 13 and in Volume 5, Appendix, WR-02-009.
- 5.1.386 Table 7 includes the surface water feature potentially affected by the AP4 amendment.

SES₃ and AP₄ ES Volume 2 – CFA₉, Central Chilterns

Table 7: Surface water feature potentially affected by the AP₄ revised scheme

Water feature	Location description (Volume 5, Water Resources and Flood Risk Assessment Map Book reference)	Watercourse classification	Water Framework Directive (WFD) water body (water body number) and current overall status	WFD status objective (by 2027 as in River Basin Management Plan)	Receptor value
River Misbourne	Parallel to route, at closest point 150m from route in tunnel. Watercourse approximately 1km from end of new tunnel section (from South Heath) (Map WR-01-09)	Main river	Misbourne WFD water body reference: GB106039029830 Poor	Good potential	High

- 5.1.387 In addition to the feature listed in Table 7, there are also a large number of ponds and drains within the study area. These are low value features and are not assessed by the Environment Agency for WFD status. The details are given in Volume 5: Appendix WR-002-009 of the main ES.
- 5.1.388 The superficial and bedrock geology is presented in Volume 2, Section 13.3 of the main ES. The extension of the Chiltern tunnel is underlain by Cretaceous White Chalk which is classified as a Principal aquifer. In this area, the chalk forms the Mid Chilterns Chalk WFD groundwater body (Environment Agency water body reference GB40601G601200). The Environment Agency has classified the overall status of the Mid Chilterns Chalk groundwater body as 'Poor Status' with an objective to achieve 'Good Status' by 2027.
- 5.1.389 Along the majority of the route the Chalk is overlain by superficial deposits, namely Clay-With-Flint, which is classified as Unproductive strata.
- 5.1.390 There are two source protection zones (SPZ¹⁵) protecting PWS abstractions (TH011 and TH316) within the study area (TH references are water source references. Refer to SES₃ and AP₄ ES, Volume 5, Water Resources and Flood Risk Map Book for their locations). One PWS (TH316) is located within the study area, and the other PWS (TH011) is located in the Chalfonts and Amersham area (CFA8). The Little Missenden ventilation shaft and the tunnel realignment between the boundary with CFA8 and Mantle's Wood is located in SPZ₂¹⁶ for the PWS source TH011. Thereafter, the tunnel realignment and the amended South Heath cutting pass through SPZ₃¹⁷ for the PWS sources TH011 and TH316.

¹⁵ Source Protection Zone (SPZ) – This is an area around a groundwater source such as a well, borehole or spring used for public drinking water supply. It is defined by the Environment Agency and used to set up pollution prevention measures in areas which are at a higher risk. There are three main zones; inner (SPZ₁), outer (SPZ₂) and total catchment (SPZ₃).

¹⁶ SPZ₂ – Defined by a 400 day travel time from a point below the water table. This zone has a minimum radius of 250 or 500 metres around the source, depending on the size of the abstraction.

¹⁷ SPZ₃ – Defined as the area around a source within which all groundwater recharge is presumed to be discharged at the source. In confined aquifers, the source catchment may be displaced some distance from the source. For heavily exploited aquifers, the final Source Catchment Protection Zone can be defined as the whole aquifer recharge area.

- 5.1.391 There is one licensed groundwater abstraction (reference GW6 in Volume 5, WR-02-009 of the main ES) and one private unlicensed groundwater abstraction (reference GWUA02 in Volume 5, WR-02-009 of the main ES) within 1km of the amendment. Further details of these abstractions can be found in Volume 5, WR-02-009 of the main ES. There are no recorded licensed or unlicensed surface water abstractions within 1km of the amendment. However, there is the potential for further unlicensed groundwater or surface water abstractions to exist, since a licence is not required for abstraction volumes below 20m³ per day.
- 5.1.392 The regional hydrogeological map shows Chalk groundwater levels in autumn 1976, (see Volume 5: WR-002-009 of the main ES for further details). The map indicates that groundwater flow is generally to the south-east with a local pattern of flows towards and into the River Misbourne when groundwater levels are high, and the reverse during periods where groundwater levels are low. Groundwater flow within the Chalk is predominantly through fractures and can be rapid making the Chalk vulnerable to contamination particularly where there are PWS or private abstractions for potable use.
- 5.1.393 The Environment Agency borehole monitoring data indicates that the maximum recorded groundwater levels were approximately 100m above ordnance datum (AOD) at the boundary with CFA8 (minimum levels were approximately 96m AOD in 1997), rising to 141m AOD at the boundary with CFA10 (minimum levels approximately 117m AOD in 1997). This suggests that peak groundwater levels are above the amendment's elevation in the tunnelled section from approximately the boundary with CFA8 to Mantle's Wood, although lower than the route's elevation in the remainder of the tunnelled section, the portal and the rest of the amendment between Mantle's Wood and the boundary with CFA10.
- 5.1.394 The amendment will cross a number of dry valleys within this area, which are shown on the updated Flood Map for Surface Water (uFMfSW) to be at risk of surface water flooding due to existing railway and highway embankments that run perpendicular to the flowpaths within the dry valleys. The uFMfSW indicates there is an increased area at risk of surface water flooding upstream of the existing embankments as a result of the blocking of overland flows by the embankments.
- 5.1.395 There are no significant risks of flooding from rivers, sewers or artificial waterbodies within the study area. As described in the main ES, the risks of groundwater flooding within the study area are minimal.

Future baseline

Construction (2017)

- 5.1.396 The future baseline for construction in 2017 remains unchanged from that reported in the main ES (Volume 2, CFA9, Section 13.3) and the SES and AP2 ES.

Operation (2026)

- 5.1.397 Current projections to the 2080s indicate that climate change may affect the future baseline against which the impacts of the amendment 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, these changes will not give rise to a new or different significant effect and will not change the level of significance of the effects reported in the main ES.

- 5.1.398 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 of the main ES.
- 5.1.399 The future baseline for operation in 2026 remains unchanged from that reported in the main ES (Volume 2, CFA9, Section 13.3) and the SES and AP2 ES.

Effects arising during construction

Groundwater

- 5.1.400 Impacts of turbidity are mostly anticipated to occur where construction takes place below the water level in the aquifer. In the main ES it was reported that tunnelling and piling/diaphragm wall construction has the potential to impact on groundwater quality and associated surface water due to the migration of fluids or suspended bedrock particles giving rise to raised turbidity. As a whole, the main ES assessed the impact to the Mid-Chilterns Chalk groundwater body and receiving surface water bodies (such as the River Misbourne) as not significant. The amendment will include an additional 1km length of tunnel which will be constructed below the groundwater level. The total length of the amendment tunnel which will be below the groundwater table will extend from the boundary of CFA8 (where the tunnel is at approximately the same elevation as the SES3 scheme) to a location close to Mantle's Wood.
- 5.1.401 Both the additional 1km length of tunnel which will be below the groundwater level, and the total length of the amendment tunnel which will be below the groundwater table, are still small compared to the scale of the classified Mid-Chilterns Chalk groundwater body. Therefore, the assessment of effect on the Mid-Chilterns Chalk groundwater body and the River Misbourne remains not significant, as reported in the main ES.
- 5.1.402 Further details of the assessment of impacts and effects in relation to the amendment are provided in SES3 and AP4 ES, Volume 5, Appendix WR-002-009.
- 5.1.403 Although effects on wider water body receptors are considered to be neutral, in the main ES it was highlighted that if fissures connect the working area of the SES3 scheme directly to high-value receptors such as PWS or private boreholes, the impact of even low levels of turbidity could cause the closure of a source due to the high quality required to be met for potable use. The sources protected by SPZ, TH011 (located in CFA8) and TH316 (in this CFA area) are close to the route. In the main ES the potential impact to these sources was assessed to be a major significant adverse effect. The amendment, with an additional 1km of tunnel located below the groundwater level, will give rise to a different significant effect on TH011 and TH316. However, this will not change the level of significance of the effects reported in the main ES.
- 5.1.404 A new Chesham Road ventilation shaft will be constructed close to Annie Bailey's public house and restaurant. In the location of the proposed new shaft, groundwater levels are estimated to be approximately 30m below the base of construction. Therefore, the new ventilation shaft will not impact on groundwater flow and impacts

on groundwater quality will be minimised in the Mid-Chilterns Chalk groundwater body. It is assessed that the impact of the new shaft on groundwater quality in the Mid-Chilterns Chalk groundwater body is negligible, with neutral effect and therefore not significant.

- 5.1.405 The Chesham Road ventilation shaft and tunnel extension are above groundwater levels and located in SPZ3 of PWS source TH011. However, there is still the potential for impacts on groundwater quality, from increased turbidity. This will result in a different significant effect on the receptor with the impact of construction assessed to be of minor impact, which for this high-value receptor, is considered to be a moderate adverse effect. Monitoring will be used to inform further mitigation requirements, if required. A hierarchy of further mitigation is set out in Volume 2, Section 13.3 of the main ES, if monitoring indicates this will be necessary.
- 5.1.406 In the main ES, the impact of the proposed South Heath green tunnel and South Heath cutting was assessed, after mitigation, to be minor with a moderate adverse effect and therefore significant. The proposed tunnel extension will not give rise to a new or different significant effect and will not change the level of significance of the effects reported in the main ES.
- 5.1.407 In the main ES, the South Heath cutting was assessed as having the potential to impact on the water level or quality in the groundwater dependent habitats of the River Misbourne, River Misbourne BAP and Doctor's Meadow. In all cases, the impact was assessed to be negligible, with neutral effect and therefore not significant. In the amendment, the South Heath cutting will be wider and deeper (by up to approximately 7m), than that proposed in the SES3 scheme. The River Misbourne, River Misbourne BAP and Doctor's Meadow are located to the south-west of the route in the Misbourne valley, with an elevation approximately 50m below the base of construction. Therefore, it is assessed that the amendment will not change the impacts reported in the main ES and impacts will remain negligible, with neutral effect and therefore not significant.
- 5.1.408 Further details of the assessment of impacts in relation to the amendment are provided in SES3 and AP4 ES, Volume 5, Appendix WR-002-009.
- 5.1.409 A number of balancing ponds, land drains and infiltration basins are located along the scheme between Chiltern tunnel north portal and the South Heath green tunnel north portal. In the main ES, the effects were assessed to be not significant. Nevertheless, since the amendment will be in bored tunnel at these locations, the majority of these ponds, infiltration basins and land drains will no longer be required and this potential effect will no longer arise.

Surface water

- 5.1.410 In the SES3 scheme, realignments of five roads (Hyde Lane, King's Lane, Frith Hill, Leather Lane and the B485 Chesham Road) were required. These were assessed to have the potential to cause minor temporary and permanent impacts on water quality in the receiving watercourse/groundwater. The effects were assessed to be not significant following standard mitigation. Nevertheless, the amendment will no longer require the realignment of Hyde Lane, King's Lane, Frith Hill or the B485 Chesham Road and therefore these potential effects will no longer arise.

Flood risk

- 5.1.411 In accordance with Section 16 of the draft CoCP (Volume 5, CT-003-000 of the main ES), excavated material storage, construction compounds and site offices will be located outside of areas at risk of flooding where reasonably practicable to avoid having an impact on the risk of flooding elsewhere. Additionally, Section 16 requires contractors to obtain the necessary consents from statutory authorities to enable discharge of dewatering and surface water run off to the public sewer or watercourses from the construction sites. In the case of the Little Missenden ventilation shaft construction compound, there will be a site-specific flood risk management plan prepared prior to construction to manage the potential risks such that there will be no impact on the risk of flooding to vulnerable receptors as a result of construction of the amendment.
- 5.1.412 As a result, no significant increase in flood risks from all sources during the construction process are identified, and therefore no significant temporary effects are expected as a result of the amendment.
- 5.1.413 All temporary areas required as part of this amendment will be returned to their previous state following construction. The amendment does not alter the effects described in the main ES since there will be no permanent effects that will increase the risk of flooding.
- 5.1.414 The main ES identified a potential to affect the risk of surface water flooding at Mantle's Wood and Farthings Wood due to the presence of cuttings across the dry valleys at these locations. The effects were assessed to be not significant. Nevertheless, since the amendment will be in bored tunnel at these locations, this potential effect will no longer arise.
- 5.1.415 The extension of the Chilterns tunnel alignment, changes to Little Missenden ventilation shaft site, and increase in width and depth of the South Heath cutting will not give rise to a new or different significant effect on water resources and flood risk and will not change the level of significance of the effects reported in the main ES.
- 5.1.416 Further details of the assessment of impacts in relation to the amendment are provided in SES3 and AP4 ES, Volume 5, Appendix WR-002-009.

Effects arising from operation

- 5.1.417 The extension of the Chilterns tunnel alignment, changes to Little Missenden ventilation shaft depth, and increase in width and depth of the South Heath cutting will not give rise to a new or different significant effect on water resources or flood risk during operation and will not change the level of significance of the effects reported in the main ES. Further detail is provided in SES3 and AP4 ES, Volume 5, Appendix WR-002-009.

Mitigation and residual effects

- 5.1.418 The assessment assumes implementation of the draft CoCP. The general approach to mitigation is set out in Volume 1, Section 9 of the main ES.
- 5.1.419 The draft CoCP sets out the measures and standards of work that will be applied to the construction of the amendment (see the main ES, Volume 5, Appendix CT-003-

ooo). These will provide effective management and control of the impacts during the construction period including those required for utility diversions and strengthening, grouting, watercourse diversions, installing culverts and tunnelling.

- 5.1.420 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required.
- 5.1.421 The amendment will give rise to different significant effects as a result of the potential for impacts on groundwater quality from increased turbidity at abstraction sources TH011 and TH316, protected by SPZ. The amendment, with an additional 1km of tunnel located below the groundwater level, will give rise to a different significant effect since the route will pass largely through SPZ2 for source TH011. However, this will not change the level of significance of the effects reported in the main ES.
- 5.1.422 The works associated with the Chesham Road ventilation shaft and tunnel extension above groundwater levels will also result in different significant effects and after mitigation the impact remains minor with a moderate effect and therefore is significant.
- 5.1.423 HS2 Ltd is working closely with Affinity Water to review the potential effects on water supply. The range of mitigation options may include the provision of a temporary alternative water supply. Temporary provision for additional treatment at Affinity PWS is included in AP4-007-003 and is reported in CFA 7 (Additional land required for the temporary provision of turbidity treatment equipment in the Colne Valley). Until a management strategy is agreed with the Environment Agency, in consultation with Affinity Water as described above, there is the potential for a likely residual significant temporary effect on the Affinity Water groundwater abstractions.

Cumulative effects

- 5.1.424 There are no new or different likely significant cumulative effects for water resources or flood risk as a result of the AP4 amendments interacting with one another, the AP1 amendments, AP2 amendments or any relevant committed developments.

Summary of new or different likely residual significant effects as a result of the amendment

New or different likely residual significant effects

- 5.1.425 New or different likely residual significant effects were reported for agriculture, forestry and soils, cultural heritage, ecology, landscape and visual assessment, traffic and transport, and water resources and flood risk assessment.

Agriculture, forestry and soils

- 5.1.426 As the amendment requires approximately 45% less BMV agricultural land than the SES3 scheme, the amendment does give rise to a different significant effect due to the reduction in the amount BMV land required. However, this does not change the level of significance of the residual effects reported in the main ES.
- 5.1.427 Holdings CFA 09/20, CFA09/21 Orchard Cottage and CFA09/22 Frith Hill Farm will experience different residual significant effects. The main ES reported a negligible effect on these holdings during operation. As a result of the AP4 amendment, these

holdings will now experience a permanent moderate adverse residual significant effect.

- 5.1.428 One additional agricultural barn demolition is required as part of the amendment (CFA09/7). This barn was not required for demolition in the SES3 scheme though the residential property was, and remains, required for demolition under the AP4 amendment which introduce a different residual significant effect although the level of significance remains as reported in the main ES.

Cultural heritage

- 5.1.429 The amendment will result in a different residual significant effect (a temporary high adverse impact resulting in moderate adverse effect) at Chiltern Cottage (asset reference CCo60), and Weights and Measures Gym (asset reference CCo61) due to changes to construction activity in this area.
- 5.1.430 The amendment will result in a different residual significant impact for Bury Farm (asset reference CCo70) and Hammondshall Farm (asset reference 094), during construction, although the level of effect reported in the main ES (moderate adverse) will remain the same.
- 5.1.431 A different residual significant effect will occur at Sheepcotts Cottage (asset reference CCo45) and The Granary at Cudsden’s Farm (asset reference CCo47) resulting in a reduced temporary medium adverse impact from construction activities associated with the new ventilation shaft, resulting in a moderate adverse effect which is significant.
- 5.1.432 There will be a different residual significant effect on Briarwood (asset reference CCo46) and artefacts on land between Hedgemoor Wood and Cudsden’s Farm (asset reference CCo35), although the level of impact and subsequent effect reported in the main ES (moderate adverse) remains unchanged.
- 5.1.433 At Annie Bailey’s public house and restaurant there will be a different residual significant effect due to construction activities at the Chesham Road ventilation shaft. There will be a significant temporary adverse impact resulting in a moderate adverse effect to its setting from construction activities, which is significant and different to the main ES.

Landscape and visual assessment

- 5.1.434 The amendment will give rise to a different residual significant effect on the Misbourne Upper North LCA and the Hyde Heath North LCA during construction. The effect will be reduced from major adverse to moderate adverse.
- 5.1.435 A different residual significant effect will occur on the Lee and Buckland Common Farmland LCA during construction. However, the significance will remain as reported in the main ES, which was major adverse.
- 5.1.436 During construction, the amendment will generate different residual significant effects and will reduce significant effects from major adverse to moderate adverse on the following viewpoints: viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties, viewpoint 089.3.003: view north from PRoW (Footpath GMI/33/5), viewpoint 089.2.004: view north-east from Cudsden's Court residential

properties, viewpoint 090.2.001: view south-west from the B485 Chesham Road and associated residential properties, and viewpoint 090.3.002: view south-west from PRoW (Footpath GMI/23/5).

- 5.1.437 The amendment will give rise to different residual significant effects but will not change the level of significance of the effects reported in the main ES on the following viewpoints in construction: viewpoint 091.3.002: view north-east from PRoW (Footpath GMI/12/1), Viewpoint 091.3.001: view north-east from PRoW (Footpath GMI/13/3); viewpoint 092.2.001: view south-west from Frith Hill including associated residential properties, viewpoint 092.3.003: view south-west from PRoW (Footpath GMI/13/3), viewpoint 093.3.001: view north-east from PRoW (Footpath GMI/12/1); Viewpoint 094.2.001: view south-west from PRoW (Footpath GMI/2/10) and residential properties on Potter Row, and viewpoint 094.2.002: view south-west from residential properties on Potter Row.
- 5.1.438 The amendment will result in a moderate adverse residual significant effect in construction on a new receptor: viewpoint AP4.091.2.003: view north-east from Bury Field House.
- 5.1.439 During operation, the amendment will generate a different residual significant effect on the Lee and Buckland Common Farmland LCA, but will not change the level of the significance of the effect reported in the main ES.
- 5.1.440 The extension of the Chiltern tunnel and the relocation of the Chiltern tunnel north portal during operation will result in a different effect and reduce the significance of the residual effect on viewpoint 087.2.002: view north from Hyde Lane and adjacent residential properties from major to moderate adverse in year 1 of operation.
- 5.1.441 The extension of the Chiltern tunnel and the relocation of the Chiltern tunnel north portal will result in a different residual significant effect on viewpoint 089.3.003: view north from PRoW (Footpath GMI/33/5), viewpoint 089.2.004: view north-east from Cudsden's Court residential properties, viewpoint 090.2.001: view south-west from B485 Chesham Road and associated residential properties, viewpoint 091.3.002: view north-east from PRoW (Footpath GMI/12/1), viewpoint 091.3.001: view north-east from PRoW (Footpath GMI/13/3), viewpoint 092.2.001: view south-west from Frith Hill including associated residential properties, viewpoint 092.3.003: view south-west from PRoW (Footpath GMI/13/3), viewpoint 093.3.001: view north-east from PRoW (Footpath GMI/12/1), viewpoint 094.2.001: view south-west from PRoW (Footpath GMI/2/10) and residential properties on Potter Row, viewpoint 094.2.002: view south-west from residential properties on Potter Row, and viewpoint 094.4.003: view west along Leather Lane. However, this will not change the level of significance of the effects reported in the main ES.

Traffic and transport

- 5.1.442 There are also new or different adverse residual significant effects during construction in relation to congestion and delays to vehicle users during construction. There is a new adverse significant residual effect at the A413/Leather Lane and the adverse residual effect at the A413 London Road/A4128 Link Road is reintroduced.
- 5.1.443 There are also new or different adverse residual significant effects during construction in relation to traffic related severance for non-motorised users. A new adverse residual

significant effect in relation to traffic related severance will occur on the A413 London Road between the B485 Frith Hill/Chesham Road and Rocky Lane (in CFA10). On the B485 Frith Hill/Chesham Road, between King's Lane and ventilation shaft S5 compound access the adverse residual significant effects increase in the level of significance. On the A413 between Hyde Lane and B485 Frith Hill/Chesham Road and on the B485 Frith Hill/Chesham Road between the A413 and King's Lane, the significant adverse residual effects reduce in the level of significance.

- 5.1.444 New adverse residual significant effects in relation to increased travel distance for non-motorised users during construction will occur at the following locations: Footpath GMI/33/4; and Footpath GMI/13/3.

Water resources and flood risk assessment

- 5.1.445 The amendment will give rise to different residual significant effects as a result of the potential for impacts on groundwater quality from increased turbidity at abstraction sources TH011 and Th316, protected by SPZ. The amendment, with an additional 1km of tunnel located below the groundwater level, will give rise to a different significant effect since the route will pass largely through SPZ2 for source TH011. However, this will not change the level of significance of the effects reported in the main ES.
- 5.1.446 HS2 Ltd is working closely with Affinity Water to review the potential effects on water supply and to develop a management strategy. Until a management strategy is agreed this temporary residual significant effect remains.
- 5.1.447 The amendment will result in different residual significant effects as a result of the potential impacts to groundwater and increased turbidity. The additional 1km of tunnel located below the groundwater level will result in a different residual significant effect, although this will not change the level of significance reported in the main ES.
- 5.1.448 The works associated with the Chesham Road ventilation shaft and tunnel extension above groundwater levels will also result in different residual significant effects, and after mitigation the impact remains minor with a moderate effect and therefore is significant.

Likely residual significant effects no longer arising

- 5.1.449 The amendment will result in residual significant effects no longer arising for agriculture, forestry and soils, community, cultural heritage, ecology, landscape and visual assessment, sound, noise and vibration, and traffic and transport.

Agriculture, forestry and soils

- 5.1.450 There will be eight residual significant adverse temporary effects (holdings: CFA09/2, CFA09/3, CFA09/5, CFA09/12, CFA09/13, CFA09/16, CFA09/19, and CFA09/17) and five residual significant adverse permanent effects (CFA09/16, CFA09/12, CFA09/5, CFA09/3, and CFA09/2) which will no longer arise.

Community

- 5.1.451 The following residual significant effects that were reported in the main ES for the construction phase will no longer arise at the following locations:
- significant temporary effects for up to 40 residential properties due to in

combination visual and noise effects and increases in HGV movements along Frith Hill;

- significant temporary effects for approximately 50 residential properties due to in combination noise effects and increases in HGV movements along King's Lane (between the B485 Chesham Road and Frith Hill);
- significant temporary effects for approximately 10 residential properties due to in combination visual effects and increases in HGV movements along Potter Row (between Frith Hill and Leather Lane);
- significant temporary effects for residents of South Heath and Ballinger Common;
- significant temporary effects for the community of South Heath due to Sibley's Coppice no longer being used during construction;
- significant permanent effects during construction in the villages of Hyde End and South Heath because the demolitions reported in the main ES are no longer required; and
- significant permanent effects on open space during construction because the amendment removes the permanent requirement for land at Mantle's Wood.

5.1.452 Permanent residual significant effects for residential properties during operation will no longer arise for approximately six properties in the vicinity of Hyde Lane in Hyde End due to combined visual and operational noise effects and for approximately 10 properties on Potter Row in South Heath due to combined visual and operational noise effects.

Cultural heritage

5.1.453 Residual significant effects on the following heritage assets during construction will no longer arise at: Mantle's Wood (asset reference CCo19), parts of the Missenden Parish Boundary (asset references CCo20 and CCo21), Farthing's Wood (asset reference CCo30), artefacts on land to the north of Rowan Farm (asset reference CCo34), Sibley's Coppice (asset reference CCo50), artefacts on land between Chesham Road and Frith Hill (asset reference CCo64) and Mantle's Wood earthworks (asset reference CCo109).

5.1.454 The setting of South Heath Farmhouse (asset reference CCo49) will also no longer be affected by the AP4 revised scheme.

5.1.455 The amendment will remove the residual significant effect on the setting of the following heritage assets during construction: The Castle, Rook Wood (asset reference CCo38), Missenden Abbey (asset reference CCo51), and moated site in Chalkdell Wood (asset reference CCo54).

5.1.456 At the Chesham Road ventilation shaft, residual significant effects will no longer arise at the following heritage assets: Hyde Farm (asset reference CCo36), Chapel Farm (asset reference CCo43), Sheepcotts (asset reference CCo43) and 86 King's Lane (asset reference CCo48).

- 5.1.457 Annie Bailey’s public house and restaurant (asset reference CCo55) was to be demolished as result of the SES3 scheme. With the AP4 amendment, the building will now be retained and the permanent residual significant construction effect will no longer arise.
- 5.1.458 Residual significant operational effects will no longer arise at Hyde Farm (asset reference CCo36) and Sheepcotts Cottage (asset reference CCo45).

Ecology

- 5.1.459 The main ES reported likely residual significant effects on Mantle’s Wood, Hedgemoor and Farthings Wood and Sibley’s Coppice due to the combined loss of approximately 9ha of ancient woodland. As a result of the amendment, the adverse residual effects significant at the county/metropolitan level reported in the main ES will not occur.
- 5.1.460 The amendment will mean that the residual significant effect on the conservation status of barn owl during operation reported in the main ES will not occur.

Landscape and visual assessment

- 5.1.461 During construction, the amendment will result in residual significant effects no longer arising on: viewpoint 086.2.001: view west from Bullbaiters Lane and Bridleway LM/27/1 towards Mantle’s Wood, viewpoint 087.2.001: view north-east from Hyde Lane and adjacent residential properties, viewpoint 087.3.003: view north from Footpath LMI/21, viewpoint 088.2.001: view south from Hyde Heath Road and residential properties on the B485 Chesham Road, viewpoint 088.4.002: view south-west from Hyde Heath Road, viewpoint 088.2.004: view south-east from PRoW (Footpath GMI/23/6) and residential property The Hyde, and viewpoint 088.4.003: view south-west from Hyde Heath Road.
- 5.1.462 During operation, the residual significant effect on the Misbourne Upper North LCA and the Hyde Heath North LCA will no longer arise as a result of the amendment. The effect will be reduced from a major adverse significant effect to a minor adverse effect which is non-significant.
- 5.1.463 During operation, the amendment will result in residual significant effects no longer arising on: viewpoint 086.2.001: view west from Bullbaiters Lane and Bridleway LM/27/1 towards Mantle’s Wood, viewpoint 087.2.001: view north-east from Hyde Lane and adjacent residential properties, viewpoint 087.3.003: view north from Footpath LMI/21, and viewpoint 088.2.001: view south from Hyde Heath Road and residential properties on the B485 Chesham Road.

Sound, noise and vibration

- 5.1.464 Residual significant construction noise effects at the residential communities in South Heath along Sibleys Rise, Bayleys Hatch and Frith Hill and residual significant noise effects on residential properties adjacent to King’s Lane arising from construction traffic on King’s Lane (south of Frith Hill), identified in the main ES are no longer likely to occur.
- 5.1.465 The residual significant operational noise effects identified in the main ES near Hyde Lane (OSV09-Co1) and Potters Row (OSV09-Co2) are no longer likely as a result of the amendment.

Traffic and transport

- 5.1.466 Residual significant adverse effects in relation to congestion and delays to vehicle users during construction will be removed at the junctions of: the B485 Frith Hill (Chesham Road)/Hyde Heath Road, the B485 Frith Hill (Chesham Road)/Kings Lane, and the B485 Frith Hill (Chesham Road)/Frith Hill.
- 5.1.467 Residual significant adverse effects in relation to traffic related severance for non-motorised users during construction will be removed at: Potter Row between Leather Lane and Frith Hill, Frith Hill between Potter Row/King's Lane and the B485 Frith Hill/Chesham Road, King's Lane between Frith Hill and the B485 Frith Hill/Chesham Road, and Hyde Heath Road between the B485 Frith Hill/Chesham Road and access to Chiltern tunnel north portal satellite compound.
- 5.1.468 Residual significant adverse effects in relation to road closures and associated diversions (causing increased travel distance and time for traffic) during construction will be removed at: Frith Hill between Potter Row/King's Lane and the B485 Frith Hill/Chesham Road; and Hyde Lane.
- 5.1.469 Residual significant adverse effects in relation to increased travel distance for non-motorised users during construction will no longer arise at the following locations: Frith Hill, Hyde Lane, Footpath GMI/79/2, Footpath GMI/80/1, Footpath GMI/79/1, Footpath GMI/28/1, Footpath GMI/28/2, Footpath LMI/17/2, and Footpath GMI/23/6.
- 5.1.470 Permanent residual significant adverse effects in relation to increased travel distance for non-motorised users are removed at: King's Lane, B485 Chesham Road, Footpath GMI/33/4, Footpath GMI/33/2, Footpath GMI/33/3, Footpath GMI/27/1, Footpath GMI/23/7, and Footpath LMI/21/1.

5.2 Realignment of diverted Footpath GMI/2 near South Heath (AP4-009-002)

- 5.2.1 The Bill provides for the diversion of Footpath GMI/2 during operation. Footpath GMI/2 remains open during construction but is then permanently diverted 200m to the west over the new Footpath GMI/2 accommodation overbridge alongside the route. The permanent diversion adds an additional 550m to the length of the PRoW (refer to map CT-05-034a and CT-06-034a in the SES3 and AP4 ES, Volume 2, CFA9 Map Book).
- 5.2.2 Since submission of the Bill, it has been decided that the route of the diversion of Footpath GMI/2 will be altered to avoid diverting the PRoW close to the route. The footpath will be rerouted to run along the outer edge of the landscape planting instead of along the inner edge, which will visually screen the route from the PRoW (refer to map CT-05-034a and CT-06-034a in the SES3 and AP4 ES, Volume 2, CFA9 Map Book).
- 5.2.3 No specific works are required to make the new route of Footpath GMI/2 suitable for use as a PRoW. The amendment will reduce the length of the footpath diversion by approximately 20m when compared to the diversion reported in the main ES. The land required for this design change is within the original limits of the Bill, however, the change to the route of the footpath requires a change to Bill powers.

- 5.2.4 The change to the route of the diverted Footpath GMI/2 is not considered to make changes that require a reassessment of the environmental effects or proposed mitigation as set out in the main ES for any environmental topic.

6 Combined effects of amendments in this CFA due to changes in traffic flows

- 6.1.1 All of the effects of the changes proposed in this CFA have been described above and there are no further combined effects to report.

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