

HIGH SPEED RAIL (LONDON - WEST MIDLANDS)

Supplementary Environmental Statement 3 and
Additional Provision 4 Environmental Statement

Volume 2 | Community forum area reports

CFA8 The Chalfonts and Amersham

October 2015

SES3 and AP4 ES 3.2.1.8



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Department for Transport

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Contents

Structure of the HS2 Supplementary Environmental Statement 3 and Additional Provision 4 Environmental Statement	1
Structure of this report	3
1 Introduction	5
Part 1: Supplementary Environmental Statement 3	7
2 Summary of changes	7
2.1 New environmental baseline information	7
2.2 Topics included in the SES ₃ assessment	8
3 Assessment of changes	9
3.1 Traffic and transport	9
3.2 Water resources and flood risk assessment	12
Part 2: Additional Provision 4 Environmental Statement	15
4 Summary of amendments	15
5 Assessment of amendments	18
5.1 Provision of the monitoring and protection of Shardeloes Park (AP ₄ -008-001)	18
5.2 Extension to the Chiltern tunnel from Mantle's Wood portal to South Heath green tunnel north portal and associated works (AP ₄ -009-001)	18
6 Combined effects of amendments in this CFA due to changes in traffic flows	37
List of figures	
Figure 1: Locations of amendments in CFA8	17
List of tables	
Table 1: Scheme definitions	5
Table 2: Summary of corrections in CFA8	8
Table 3: Summary of amendments in CFA8	16

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 SES2 (and SES3 for the AP4 amendments). The AP1, AP2 and AP3 amendments are 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 SES 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 traffic and transport and water resources and flood risk assessment; and
- a correction to the SES or AP₂ ES.

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

- 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 AP ₁ 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 AP ₂ revised scheme	the SES scheme as amended by the AP ₂ submitted in July 2015	4 – 26
the SES ₂ scheme	the original scheme as updated by the SES scheme, with the design changes described in the SES ₂ submitted in September 2015	1 – 5 (i.e. this applies in the London area only)
the AP ₃ revised scheme	the SES ₂ scheme as amended by the AP ₃ submitted in September 2015	1 – 5 (i.e. this applies in the London area only)
the SES ₃ scheme	the SES ₂ scheme with the design changes described in the SES ₃ submitted in October 2015	4 – 26

Scheme name	Definition	Relevant CFAs
the AP ₄ revised scheme	the SES ₃ scheme as amended by the AP ₄ submitted in October 2015	4 – 26

- 1.1.5 SES₃ (Part 1 of this report) contains updated environmental baseline information. This includes new baseline information with respect to traffic and transport and water resources and flood risk assessment.
- 1.1.6 SES₃ contains a correction to the SES or AP₂ ES.
- 1.1.7 The updated baseline information is described in Part 1 under a series of sub-headings, and assessed on a topic by topic basis using the same approach adopted in the main ES.
- 1.1.8 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.
- 1.1.9 There were no SES₂ changes in this CFA, so the SES₃ changes are compared to the SES scheme.
- 1.1.10 There were no design changes assessed in the SES₃ for this CFA.
- 1.1.11 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 AP₄ for this CFA include:
- provision for the monitoring and protection of Shardeloes Park; and
 - extension to the Chiltern tunnel from Mantle’s Wood portal to South Heath green tunnel north portal and associated works.
- 1.1.12 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.
- 1.1.13 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

Traffic and transport

2.1.1 Additional traffic surveys have been undertaken at junctions in the Chalfonts and Amersham area to supplement the information reported in the main ES. The impacts of traffic associated with HS2 construction has been reassessed in the context of this supplementary information.

2.1.2 Details of the survey data are included in SES₃ and AP₄ ES, Volume 5: Appendix TR-001-000. The assessment of the additional baseline data is reported in Section 3.

Water resources and flood risk assessment

2.1.3 Since the main ES was published the Environment Agency has amended the source protection zones (SPZ) for a number of public water supply abstractions in the Chilterns area. The impact of water resources and flood risk associated with HS2 construction has been re-assessed in the context of this revised baseline in Section 3.

Corrections

2.1.4 Since submission of the SES₂ and AP₃ ES, the need for a number of corrections in the content of the SES and AP₂ ES reports has been identified. Table 2 sets out where there has been a need to correct the Volume 2 CFA report for the Chalfonts and Amersham area because of the potential to alter the significant environmental effects reported, or a factual inaccuracy relating to significant effects has been identified. The table gives the location of the correction in the relevant ES, the reason for the correction, replicates the text, where applicable provides revised text, and identifies whether the correction changes a significant effect reported. Where relevant, these corrections have been taken into account in the technical assessments contained within Section 3 of this SES.

Table 2: Summary of corrections in CFA8

Reference in the relevant ES	Reason for correction	Text in the relevant ES	Revised text	Change to significant effects and mitigation
Traffic and transport: Paragraph 3.1.4, Volume 2, CFA8 of the SES and AP2 ES.	The paragraph incorrectly stated that the movement of excavated material was removed from the A404 Whielden Lane (between the A413 Amersham Bypass and Whielden Street).	Paragraph 3.1.4: 'The movement of excavated material is also removed from the A404 Whielden Lane (between the A413 Amersham Bypass and Whielden Street).'	Removal of the following sentence from Paragraph 3.1.4: 'The movement of excavated material is also removed from the A404 Whielden Lane (between the A413 Amersham Bypass and Whielden Street).'	Yes. The correction identifies that the moderate adverse significant effect with regard to traffic-related severance for non-motorised users on A404 Whielden Lane (between the A413 Amersham Bypass and Whielden Street) reported in the main ES remains regardless of the SES change. No changes to the mitigation proposed in the main ES are required.

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 traffic and transport; and water resources and flood risk assessment.

3 Assessment of changes

3.1 Traffic and transport

Introduction

- 3.1.1 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 those of the SES scheme and any relevant AP2 amendments.

Scope, assumptions and limitations

- 3.1.2 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

- 3.1.3 Supplementary traffic data has been collected at the following highway junctions and sections of highway, that are the subject of a revised assessment:

- A40 London Road/A355 Pyebush Roundabout;
- A413 Amersham Bypass with A404 Whielden Lane (Crematorium roundabout);
- A404 Whielden Lane with Whielden Street;
- A355/Ledborough Lane;
- A40 London Road/A355 London End;
- A413/School Lane (Amersham Old Town)/Shardeloes;
- A413 Amersham Road (Chalfont St. Giles); and
- A40 London Road, between London End and Pyebush Roundabout.

Environmental baseline

Existing baseline

- 3.1.4 The existing baseline for traffic and transport is as out in Volume 2, CFA8, Section 12 of the main ES, updated by the additional traffic surveys presented in the SES₃ and AP₄ ES, Volume 5: Appendix TR-001-000.

Future baseline

Construction

- 3.1.5 The future baseline for construction as reported in the main ES (Volume 2, CFA8, Section 12), updated by the additional traffic surveys.

Operation (2026 and 2041)

- 3.1.6 The future baselines for operation are as reported in the main ES (Volume 2, CFA8, Section 12), updated by the additional traffic surveys.

Effects arising during construction

Avoidance and mitigation measures

- 3.1.7 No avoidance and mitigation measures additional to those reported in Volume 2, CFA8, Section 12 of the main ES are proposed.

Assessment of impacts and effects

Temporary effects

- 3.1.8 The supplementary traffic data has the potential to change the assessment of the impacts of HS2 construction traffic on the local network in relation to congestion and delays to vehicle users and to traffic related severance for non-motorised users.
- 3.1.9 The revised assessment has identified new or different likely significant effects in relation to congestion and delays to vehicle users at the following junctions:
- A40 London Road/A355 London End: a new major adverse significant effect (previously assessed as non-significant); and
 - A413/School Lane (Amersham Old Town)/Shardeloes: a minor adverse significant effect (previously a major adverse significant effect reported in the SES and AP2 ES and a moderate adverse significant effect based upon the lower flows reported in the main ES).
- 3.1.10 The revised assessment has not identified any new or different likely residual significant effects at any of the other junctions assessed compared to those reported in the main ES and the SES and AP2 ES.
- 3.1.11 The revised assessment has identified one new significant effect and the removal of a significant effect in relation to traffic related severance for non-motorised users at the following locations:
- A40 London Road, between London End and Pyebush Roundabout : a new major adverse significant effect (previously assessed as non-significant); and
 - A413 Amersham Road, between Joiners Lane and Chalfont St Giles: the removal of the moderate adverse significant effect reported in the SES and AP2 ES. The impact on the A413 Amersham Road, between Chalfont St Giles and Bottom House Farm Lane, remains a moderate adverse effect, as reported in the SES and AP2 ES.

Permanent effects

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

Other mitigation measures

- 3.1.13 No changes to mitigation measures reported in Volume 2, CFA8, Section 12 of the main ES, SES and AP2 ES are proposed.

Cumulative effects

- 3.1.14 The above assessment has taken into account cumulative effects, including any planned development by taking account of background traffic growth, as well as traffic and transport impacts of works being undertaken in neighbouring areas.
- 3.1.15 There are no new or different likely significant cumulative effects for traffic and transport.

Summary of likely residual significant effects

- 3.1.16 The SES₃ assessment has identified a new major adverse significant residual effect at the A₄₀ London Road with A₃₅₅ London End junction, in relation to junction congestion and delay to vehicle users. It also identifies a minor adverse significant residual effect at the A₄₁₃ with School Lane (Amersham Old Town)/Shardeloes junction (a major adverse significant effect reported in the SES and AP₂ ES).
- 3.1.17 In addition, the SES₃ assessment has identified there will be a new major adverse significant residual effect on the A₄₀ London Road, between London End and Pyebush Roundabout in relation to traffic related severance for non-motorised users. It also identifies the removal of the moderate adverse significant residual effect reported in the SES and AP₂ ES on the A₄₁₃ Amersham Road, between Joiners Lane and Chalfont St Giles.
- 3.1.18 The correction referred to in Table 2 has resulted in a new moderate adverse significant residual effect, with regard to traffic related severance for non-motorised users, on the A₄₀₄ Whielden Lane (between the A₄₁₃ Amersham Bypass and Whielden Street).
- 3.1.19 The significant effects that result from the construction of the SES₃ scheme are shown on map series TR-03 in the SES₃ and AP₄ ES, Volume 5, Traffic and Transport Map Book.

Effects arising from operation

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

3.2 Water resources and flood risk assessment

Introduction

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

Scope, assumptions and limitations

- 3.2.2 The assessment scope, key assumptions and limitations for water resources and flood risk 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.

SES₃ changes of relevance to this assessment

- 3.2.3 Since the main ES was published, the Environment Agency has amended the SPZs for a number of public water supply abstractions in the wider Chilterns area. The impact on water resources and flood risk assessment associated with HS2 construction has been reassessed in the context of this revised baseline.

Environmental baseline

Existing baseline

- 3.2.4 The existing baseline for water resources and flood risk is set out in Volume 2, CFA8, Section 13 of the main ES, updated with the new source protection zone data shown in map WR-02 in the SES₃ and AP₄ Volume 5 Water Resources and Flood Risk Map Book.
- 3.2.5 The main ES reported that in CFA8 the original scheme would pass in tunnel through SPZ₂ and SPZ₃ of the Public Water Supplies (PWS) TH₀₂₇, TH₀₂₈, TH₀₁₁, TH₁₇₁ and TH₁₈₁ (TH references are water source references. Refer to SES₃ and AP₄ ES, Volume 5, Water Resources and Flood Risk Map Book, WR-02 for their locations). Taking into account the new baseline data on SPZs, the route will now pass through SPZ₁ and SPZ₂ of TH₀₁₁. As for the original scheme, the route will pass through the SPZ₂ and SPZ₃ of the sources TH₀₂₇, TH₀₂₈, TH₁₇₁ and TH₁₈₁. Reassessment has therefore not been undertaken in relation to TH₀₂₇, TH₀₂₈, TH₁₇₁ and TH₁₈₁.

Future baseline

Construction (2017)

- 3.2.6 All committed developments are required to comply with the National Planning Policy Framework development plans and other legislation and guidance. As such committed developments are not expected to have a material effect on the water resources and flood risk baseline. The potential change in Water Framework Directive (WFD) status objectives is not considered to result in the effects from the original scheme changing in significance.

Operation (2026)

- 3.2.7 For the reasons stated above for construction, the committed developments will not result in a change in significance of the effects from operation.

Effects arising during construction

Avoidance and mitigation measures

- 3.2.8 No avoidance or mitigation measures, additional to those reported in the main ES (Volume 2, CFA 8, Section 13) are required.

Assessment of impacts and effects

Temporary effects

- 3.2.9 In the main ES (Volume 2, CFA 8, Section 13) it was assessed that construction of the Chiltern tunnel, including tunnelling and piling/diaphragm wall construction, has the potential to impact on groundwater quality. If fissures connect the working area of the original scheme directly to the high-value Affinity Water groundwater abstraction THo11, the impact of low levels of turbidity was assessed to be moderate due to the high quality required to be met for potable use, resulting in a large and therefore, significant effect.
- 3.2.10 Applying the new baseline information to the assessment for the PWS source THo11, the impact is predicted to increase from moderate to major, since the route will now pass through SPZ1 for this source. As source THo11 is a high value receptor, the likely effect without other mitigation measures is assessed as very large, which is significant.
- 3.2.11 The change in SPZ baseline data will give rise to a different significant effect on the assessment of impact of construction on PWS abstraction THo11. This will change the level of significance of the effects reported in the main ES from moderate to major effect.

Permanent effects

- 3.2.12 The change in baseline data on SPZs 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.

Other mitigation measures

- 3.2.13 Mitigation set out in the main ES included implementation of the draft CoCP and monitoring until any impacts have been assessed. The monitoring data would be used to define appropriate further mitigation, should it be required. Further mitigation measures included a management strategy that is being developed with Affinity Water (and in agreement with the Environment Agency) to be put in place temporarily to ensure supplies to customers are not affected. However, until the strategy is agreed there would be a potential residual significant effect on these PWS.

- 3.2.14 This change in baseline does not change the other mitigation measures reported in Volume 2, CFA8 of the main ES.

Cumulative effects

- 3.2.15 There are no new or different likely significant cumulative effects for water resources and flood risk assessment as a result of the SES₃ changes interacting with one another, or any relevant committed development.

Summary of likely residual significant effects

- 3.2.16 The amended SPZ data issued by the Environment Agency will give rise to a different significant effect. The change in baseline will change the level of significance of the effects reported in the main ES from large to very large, until the management strategy with Affinity Water is in place. HS2 Ltd is working closely with Affinity Water to review the potential effects on water supply. Until a management strategy is agreed with the Environment Agency in consultation with Affinity Water, one significant temporary residual effect on water quality to the PWS abstraction TH011 remains.

Effects arising from operation

- 3.2.17 The SES₃ changes do not change the operation of the scheme and so there are no new or different significant operation effects for water resources and flood risk assessment as a result of the SES₃ baseline changes, in comparison with the main ES or SES.

Part 2: Additional Provision 4 Environmental Statement

4 Summary of amendments

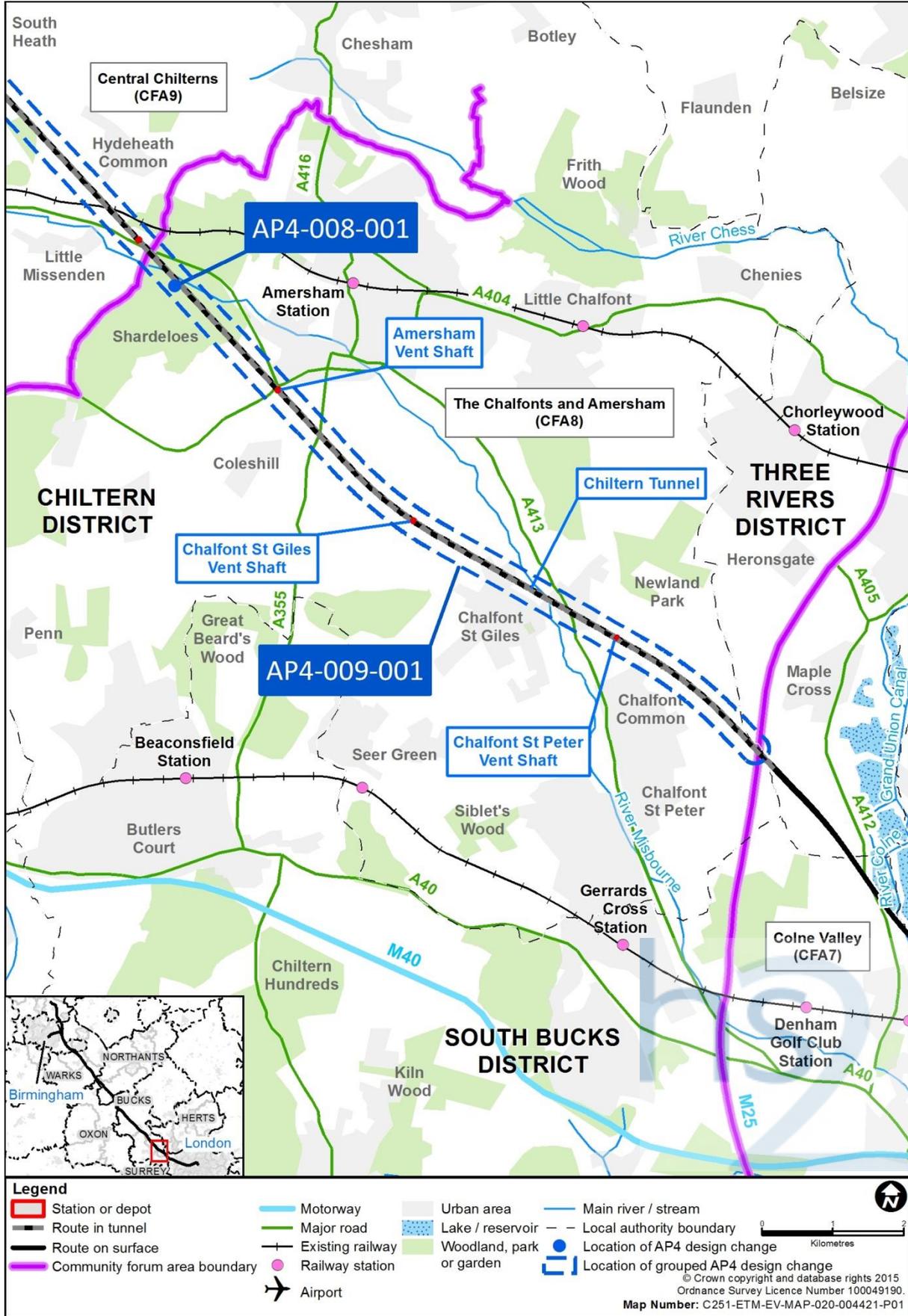
- 4.1.1 Table 3 provides a summary of the amendments in the Chalfonts and Amersham area (CFA 8) and Figure 1 shows the locations.

Table 3: Summary of amendments in CFA8

Name of amendment	Description of the SES ₃ scheme.	Description of the AP ₄ revised scheme
<p>Provision for the monitoring and protection of Shardeloes Park (AP₄-008-001)</p>	<p>The Chiltern tunnel route is directly beneath the Shardeloes Estate which includes the Grade II listed 'buildings and walls of the kitchen gardens of Shardeloes Park'.</p>	<p>The Grade II listed 'buildings and walls of the kitchen gardens of Shardeloes Park' is to be included in the Bill as authorised to be altered or extended for heritage or monitoring purposes. This will enable it to be monitored and protected.</p> <p>This is an amendment to Bill powers only and no additional land is required.</p>
<p>Extension to the Chiltern tunnel from Mantle's Wood portal to South Heath green tunnel north portal and associated works (AP₄-009-001)</p>	<p>The original scheme would emerge from tunnel at Mantle's Wood, in CFA₉ continue north-west mainly in deep cutting, as far as 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 original scheme would continue north-west in a cutting, up to 11m deep in this area, north to Leather Lane.</p> <p>The original scheme provided 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 portal¹.</p>	<p>Extension of the bored Chiltern tunnel in CFA₉ by approximately 2.6km from Mantle's Wood, north-west of Hyde Heath emerging at a revised Chiltern tunnel north portal, located north-west of South Heath.</p> <p>The changes within CFA₈ associated with the extension of the Chiltern tunnel are listed below:</p> <ul style="list-style-type: none"> - revised design of Chalfont St Peter ventilation shaft and auto-transformer station (ATS) (CFA₈); - revised design of Chalfont St Giles ventilation shaft and ATS (CFA₈); and - increase in depth and width of bored tunnel alignment (CFA₈ and CFA₉). <p>Additional land within CFA₈ is required which is outside of the Bill limits.</p>

¹ 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.

Figure 1: Locations of amendments in CFA8



5 Assessment of amendments

5.1 Provision of the monitoring and protection of Shardeloes Park (AP4-008-001)

- 5.1.1 The Bill provides for the Chiltern tunnel which passes directly beneath the Shardeloes Estate. The Shardeloes Estate includes the Grade II listed 'buildings and walls of the kitchen gardens of Shardeloes Park'.
- 5.1.2 Since submission of the Bill, it has been identified that parts of the Grade II listed assets (namely the walls of the garden) are in particularly poor condition. These parts of the listed assets are within the 10mm settlement contour. As a result, the Grade II listed 'buildings and walls of the kitchen gardens of Shardeloes Park' will be included in the Bill as authorised to be altered or extended for heritage or monitoring purposes. This will enable it to be monitored and protected. This is an amendment to the Bill and does not affect what has been reported in the main ES (Volume 2, CFA8, Section 2).
- 5.1.3 The monitoring and protection of Shardeloes Park is 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 any environmental topics.

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

- 5.2.1 The original scheme provides for the route to pass beneath part of the Chilterns Area of Outstanding Natural Beauty (AONB) in tunnel. The original scheme for the Chiltern tunnel would provide 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 would be four ventilation and intervention shafts along the length of the Chiltern tunnel, near Chalfont St Peter, Chalfont St Giles, Amersham (all CFA8) and near Little Missenden (CFA9).
- 5.2.2 Upon emerging from the Chiltern tunnel (CFA9), the original scheme would continue north-west in a cutting, up to 23m deep, for approximately 750m, then on an embankment, up to 5m high, for approximately 100m. It would then continue in a cutting, up to 13m deep, for approximately 650m up to the B485 Chesham Road, south-west of South Heath. The SES3 scheme would enter the South Heath green tunnel adjacent to the B485 Chesham Road and would continue 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 original scheme would continue north-west in a cutting, up to 11m deep in this area, north of Leather Lane (and would continue 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).

- 5.2.3 The original scheme allowed 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.
- 5.2.4 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 HS2 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 revised scheme were within CFA9.
- 5.2.5 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 that 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).
- 5.2.6 This amendment includes changes to the scheme design in CFA9 and CFA10, as well as changes in CFA7 in relation to air quality and traffic. These are described in the relevant CFA reports.
- 5.2.7 If the AP4 revised scheme is approved the AP2 revised scheme will not be pursued.
- 5.2.8 This amendment includes changes to the scheme design in CFA8, CFA9 and CFA10, as well as changes in CFA7 in relation to traffic. These are described in the relevant SES3 and AP4 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 original 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 ventilation shaft in CFA8, and Little Missenden and Chesham Road in CFA9. There will be no additional land 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 Little Missenden and auto-transformer feeder station (CFA9);

- a new ventilation shaft located adjacent to Annie Bailey's public house and restaurant with access from 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 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 (approximately 11m higher than the existing pylons);
- 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 (CFA9 and CFA10);
- the Chiltern tunnel north portal construction compound, including a rail fit-out compound will be accessed via the A413 Missenden Bypass. This area will be restored to its former use following the rail fit-out stage with a permanent access provided from Frith Hill to the new portal (CFA9);
- the provision for 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 (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 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 HS2 route north of Leather Lane with access from Leather Lane (CFA10).

5.2.9 The amendment will result in an overall net reduction in the land required across CFA8, CFA9 and CFA10. In particular, the removal of approximately 9ha of ancient woodland from Mantle's Wood, Farthings Wood and Sibley's Coppice in CFA9 is no longer required. In CFA8, 0.13ha of additional land is required at Chalfont St Giles ventilation shaft and ATS during construction and permanently which is outside of Bill limits. The elements of the amendment within CFA8 are described in detail in the following sections.

Chalfont St Peter ventilation shaft and ATS

5.2.10 North-west of Chalfont St Peter, the main ES provides for the Chalfont St Peter ventilation shaft, required to provide pressure relief from the tunnels (as described in Section 2.2 Volume 2, CFA8 in the main ES), a dedicated intervention point and access for emergency services. This ventilation shaft would be located approximately 50m

from Chesham Lane to the south of Ashwell's Farm (see maps CT-05-024 and CT-06-024 in the main ES Volume 2, CFA8 Map Book).

- 5.2.11 The original scheme provides for landscape earthworks, curving along the northern and western side of the ventilation shaft compound to integrate it into the landscape. Additionally, areas of planting along the northern and western edges of the ventilation shaft compound screen views from the surrounding residents in Chalfont St Peter and Chalfont St Giles.
- 5.2.12 The extension to the tunnel requires a revised design to the ATS to provide for the addition of tunnel cooling equipment (chillers) and accompanying electrical switchgear (chiller plant) . The chillers and chiller plant will occupy an approximately 13m by 8m area and be approximately 3m in height. The construction works are not expected to result in additional vehicle movements compared to those presented in the main ES.
- 5.2.13 The changes at the Chalfont St Peter ventilation shaft and ATS do not change the area required permanently. The additional equipment will remain within the original limits of the Bill and therefore no amendment to the Bill is required.

Chalfont St Giles ventilation shaft and ATS

- 5.2.14 North-west of Chalfont St Giles, the original scheme provides for the Chalfont St Giles 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 in an open field approximately 300m south-west of Upper Bottom House Farm (see map CT-06-026 in Volume 2, CFA8 Map Book in the main ES). Associated with this ventilation shaft is an ATS, 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.
- 5.2.15 The original scheme provides for planting along the northern, western and eastern boundaries of this ventilation shaft compound to screen views from the surrounding residents and landscape earthworks located at the north side of the ventilation shaft compound to integrate it into the landscape.
- 5.2.16 The extension to the tunnel requires that the ATS is altered to an express feeder ATS that is required to improve the voltage level along the line, by accommodating further electrical sub-distribution equipment. The footprint of the structure will be enlarged by approximately 0.15ha. The height of the express feeder ATS is approximately 5m. The proposed mitigation earthworks and planting will be remodelled to accommodate a larger structure. The construction works are not expected to result in additional vehicle movements compared to those presented in the main ES. The ventilation shaft will also require tunnel cooling equipment (chillers) and accompanying electrical switchgear (chiller plant) required to accommodate an extension to the Chiltern tunnel.

- 5.2.17 The express feeder ATS and remodelled landscape earthworks and planting will require 0.13ha of additional land permanently outside of Bill limits. The revised design is shown on maps CT-05-026 and CT-06-026 in the SES₃ and AP₄ ES Volume 2, CFA8 Map Book.

Amersham ventilation shaft

- 5.2.18 North-west of Chalfont St Giles, the main ES provides for the Amersham ventilation shaft, required to provide pressure relief from the tunnels (as described in Section 2.2 in the main ES), a dedicated intervention point and access for emergency services. This ventilation shaft would be located in the isolated parcel of land at the junction of the A₄₀₄ Whielden Lane and the A₄₁₃, south of Amersham Hospital (see maps CT-05-028 and CT-06-028 in the main ES Volume 2, CFA8 Map Book).
- 5.2.19 The original scheme provides for planting around the outer perimeter of the ventilation shaft compound for visual screening and a strip of planting along the northern edge of the A₄₀₄ between the Chilterns Crematorium and the A₄₁₃ for visual screening.
- 5.2.20 The extension to the tunnel requires a revised design to the ATS to provide for the addition of chillers and accompanying chiller plant. This is not expected to change the traffic flows in the area because additional vehicle movements compared to those presented in the main ES are not expected.

Extension to bored Chiltern tunnel

- 5.2.21 The original 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. The tunnel would have emerged through a portal at Mantle's Wood in CFA₉.
- 5.2.22 The AP₄ revised scheme will have a lower vertical alignment from the Shardeloes Estate in CFA₈ to approximately 250m south of Liberty Lane (CFA₉). Within CFA₈, the vertical alignment of the Chiltern tunnel will be lowered for approximately 0.5km from the Shardeloes Estate to the CFA₉ boundary at Mop End Lane.
- 5.2.23 The difference in vertical alignment between the AP₄ revised scheme and original scheme will vary by up to 32m through this section. The horizontal alignment of the Chilterns tunnel remains unchanged from the original scheme and the line speed will remain at 320kph through the tunnels.
- 5.2.24 Further details of the changes occurring as a result of the extension of the bored tunnel are described in the SES₃ and AP₄ ES Volume 2, CFA₉.

Changes to local construction programme

- 5.2.25 The additional tunnel boring works required for the amendment (AP4-009-001) are estimated to take up to 10 months longer than the original scheme. However, by using the new compound, Chiltern tunnel north portal (rail systems) satellite compound, at the Chiltern north portal, to enable the rail systems to be installed from both north and south portals, the time taken for that fit-out would be shortened, enabling the overall construction programme reported in the main ES to be maintained.

Topics included in the assessment

- 5.2.26 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 CFA8, 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, community, ecology, land quality, socio-economics, sound, noise and vibration, and traffic and transport. However, there were changes where reassessment was considered to be required within CFA8 in respect of: agriculture, forestry and soils, cultural heritage, landscape and visual assessment, and water resources and flood risk assessment.

Agriculture, forestry and soils

Introduction

- 5.2.27 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

- 5.2.28 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) of the main ES.
- 5.2.29 The effects related to the works at the Chalfont St Giles ventilation shaft and ATS have been scoped in for agriculture, forestry and soils. The works at Chalfont St Peter ventilation shaft and ATS and the extension of the bored tunnel have been scoped out.
- 5.2.30 The area of agricultural land permanently required to accommodate the revised layout of the Chalfont St Giles ventilation shaft and ATS extends to approximately 0.3ha. Although the land is classified as best and most versatile (BMV), the amendment will not alter the significance of effect, or result in any different effect, in terms of the loss of BMV agricultural land within the Chalfonts and Amersham area. The route-wide effects on BMV land and forestry land are reported in Volume 3.

Existing baseline

- 5.2.31 A single agricultural holding will be affected by the amendment in CFA8. Lower Bottom House Farm (CFA08/4²) is a 121ha grassland holding. All the grassland is either let for grazing or hay making. Diversified activities are also undertaken including clay pigeon shooting, and storage.

Future baseline

Construction (2017)

- 5.2.32 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, CFA8, Section 3.3).
- 5.2.33 None of the identified developments affect the assessment of the AP4 amendments's likely construction impacts on agriculture, forestry and soils.
- 5.2.34 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)

- 5.2.35 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, CFA8, Section 3.3).
- 5.2.36 None of the identified developments affect the assessment of the AP4 amendment's likely operational impacts on agriculture, forestry and soils.

Effects arising during construction

- 5.2.37 The main ES reported that 3.5ha of land was required to be removed permanently from Lower Bottom House Farm for the construction of the original scheme. This represented 3% of Lower Bottom House Farm and was assessed as a negligible effect, which is not significant. The additional area of land that will be removed from agricultural production is approximately 0.13ha and increases the area of land required to 3.6ha. This still represents 3% of the holding and does not result in a new or different significant effect or change the level of significance reported in the main ES.

Effects arising from operation

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

² Holding reference number assigned in main ES.

Mitigation and residual effects

- 5.2.39 No additional mitigation measures (i.e. in addition to those identified in the main ES and subsequent SES reports) are required. However, the mitigation proposed in the main ES will be remodelled.

Cumulative effects

- 5.2.40 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 or any relevant committed development.

Cultural heritage

Introduction

- 5.2.41 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

- 5.2.42 The assessment scope, key assumptions and limitations for cultural heritage are as set out Volume 1, the SMR (Volume 5: Appendix CT-001 -000) and the SMR Addendum (Volume 5: Appendix CT-001-000) of the main ES.
- 5.2.43 The effects related to the works at the Chalfont St Peter ventilation shaft and ATS and Chalfont St Giles ventilation shaft and ATS and the extension of the bored tunnel have been scoped in for cultural heritage.

Existing baseline

- 5.2.44 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.

Extension to the bored Chiltern tunnel

- 5.2.45 No additional land is required for the extension to the bored tunnel. As the tunnel is below ground it does not encroach on the setting of any heritage assets.

Chalfont St Peter ventilation shaft and ATS

- 5.2.46 No additional land is required for the alterations to the Chalfont St Peter ventilation shaft and ATS. The land required does not encroach on any heritage assets. Ashwell Farm (asset reference CHA017), a 17th century timber framed farmhouse and barn of moderate heritage value, is located approximately 50m to the north-east of the land required for the ventilation shaft, ATS and associated landscaping.

Chalfont St Giles ventilation shaft and ATS

- 5.2.47 An additional 0.13ha of land outside of Bill limits is required for the alterations to the Chalfont St Giles ventilation shaft, ATS and associated landscaping. The land required for access is within the Upper Bottom Farm complex (asset reference CHA032) an asset of low heritage value. Lower Bottom Farm (asset reference CHA031), a group of Grade II listed buildings of moderate heritage value, sits adjacent to construction access on Bottom House Farm Lane.

Future baseline

Construction (2017)

- 5.2.48 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 and AP2 ES (Volume 5: Appendix CT-004-000).
- 5.2.49 None of the identified developments affect the assessment of the AP4 amendment's likely construction impacts on cultural heritage.

Operation (2026)

- 5.2.50 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, CFA8, Section 6.3), SES and AP2 ES.
- 5.2.51 None of the identified developments affect the assessment of the AP4 amendment's likely operational impacts on cultural heritage.

Effects arising during construction

- 5.2.52 The extension to the bored tunnel, alterations to Chalfont St Peter ventilation shaft, and ATS, do not require additional land to that required in the original scheme. An additional 0.13ha of land is required for the Chalfont St Giles ventilation shaft and ATS, this land does not encroach on any heritage assets or their setting. The alterations to the equipment within the ventilation shafts and ATS associated landscaping will not have any further effect on the setting of any heritage assets than that reported in the main ES.
- 5.2.53 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 main ES reported no significant effects from construction.

Effects arising from operation

- 5.2.54 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 main ES reported no significant effects during operation.

Mitigation and residual effects

- 5.2.55 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required. The amendment will result in no change in the likely residual significant effects reported in the main ES.

Cumulative effects

- 5.2.56 There are no new or different likely significant cumulative effects for cultural heritage as a result of the AP4 amendments interacting with one another or any relevant committed development.

Landscape and visual assessment

Introduction

- 5.2.57 This section of the report describes the environmental baseline in relation to landscape and visual assessment 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

- 5.2.58 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.
- 5.2.59 The effects related to the works at the Chalfont St Giles ventilation shaft and ATS have been scoped in for landscape and visual. The effects related to the Chalfont St Peter ventilation shaft and ATS have been scoped out due to the minor nature of the changes to the original scheme. The extension of the bored tunnel has also been scoped out.

Existing baseline

- 5.2.60 The area of land required for the revised Chalfont St Giles ventilation shaft and ATS is located within Penn South Landscape Character Area (LCA) as described in the main ES (Volume 2, CFA8, Section 9). This LCA is characterised by large scale, rolling topography with numerous dry valleys, arable and pastoral fields with large blocks of woodland, and small settlements and individual properties. Shardeloes, a large Grade II* registered park and garden, is located within the LCA and sits within the wider designation of the Chilterns AONB. The character area has a high sensitivity to change.
- 5.2.61 Viewpoints located in close proximity to the area of the amendment and which are described in the main ES (Volume 2, CFA8, Section 9.3) are:
- Viewpoint 071.2.001: view north-west from Bottom House Farm Lane;
 - Viewpoint 071.3.002: view north from public right of way (PRoW) (Footpath Col/2/2); and
 - Viewpoint 072.2.001: view west from Bottom House Farm Lane.

Future baseline

Construction (2017)

- 5.2.62 The future baseline for construction in 2017 remains unchanged from that reported in the main ES (Volume2, CFA8, Section 9.3).

Operation (2026)

- 5.2.63 The future baseline for operation in 2017 remains unchanged from that reported in the main ES (Volume 2, CFA8, Section 9.3).

Effects arising during construction

Landscape assessment

- 5.2.64 The main ES reported a moderate adverse effect during construction on the Penn South LCA due to the presence of large construction plant including cranes and associated construction traffic which will reduce tranquillity within the LCA.
- 5.2.65 Although the footprint will increase, additional land outside of Bill limits is not required for the alterations to the Chalfont St Giles ventilation shaft, ATS and associated landscaping. As the works will be within the Bill limits assessed in the main ES and the scale of the changes are relatively small, the construction of the revised Chalfont St Giles ventilation shaft and ATS 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.

Visual assessment

- 5.2.66 Viewpoint 071.2.001: view north-west from Bottom House Farm Lane was assessed as being affected by the original scheme and will also be affected by this amendment. The main ES reported a moderate adverse effect during construction, which is significant, due to the Chalfont St Giles ventilation shaft satellite compound which surrounds the ventilation shaft and ATS and associated large plant and excavated material stockpiles, being dominant elements in the background of the view. Although the footprint of the structures required for the alterations to the Chalfont St Giles ventilation shaft and ATS will increase, no additional land outside of Bill limits is required and the scale of construction activity will be similar to the original scheme. As the receptor is approximately 500m distant and the view will be filtered by trees, the changes will not be discernible from the original scheme. 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.
- 5.2.67 Viewpoint 071.3.002: view north from PRow (Footpath Col/2/2) was assessed as being affected by the original scheme and will also be affected by this amendment. The main ES reported a major adverse effect during construction, which is significant, due to the presence of the Chalfont St Giles ventilation shaft satellite compound, cranes and deposited temporary material stockpiles being visible in the middle ground of the view (approximately 270m distance) but partially filtered by tree lined field boundaries. As the receptor is approximately 270m distant and the view will be filtered by trees,

the change will not be discernible from the original scheme. 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.

- 5.2.68 Viewpoint 072.2.001: view west from Bottom House Farm Lane was assessed as being affected by the original scheme and will also be affected by this amendment. The main ES reported a major adverse effect during construction, which is significant, due to views of the construction plant including cranes, increased construction traffic along Bottom House Farm Lane and temporary material stockpiles in the adjacent agricultural field but partially filtered by trees. The scale of construction activity will be similar to the original scheme. As the receptor is approximately 500m distant and the view will be filtered by trees, the changes will not be discernible from the original scheme. 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.

Effects arising from operation

Landscape assessment

- 5.2.69 The main ES predicted a minor adverse and non-significant effect in year 1 and a negligible effect in year 15 and 60 on the Penn South LCA, as the original scheme elements will be relatively small in scale and will not be perceptible in the large majority of the LCA. Although the footprint of the structures required for the alterations to the Chalfont St Giles ventilation shaft and ATS will increase, the scale of structures and landscape planting will be similar to the original scheme. The additional permanent land required of 0.3ha will not change the low magnitude of change reported in the main ES in year 1, and the establishment of the proposed planting will integrate the structures into the landscape in years 15 and 60. The construction of the revised Chalfont St Giles ventilation shaft and ATS 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.

Visual assessment

- 5.2.70 Viewpoint 071.2.001: view north-west from Bottom House Farm Lane was assessed as being affected by the original scheme and will also be affected by this amendment. The main ES reported a moderate adverse effect during year 1 of operation due to the Chalfont St Giles ventilation shaft and ATS being visible through tree lined field boundaries in the middle ground of the view. This reduced to minor adverse in year 15 and negligible in year 60, as mitigation planting and earthworks will greatly reduce the visibility of the ventilation shaft. As the receptor is approximately 500m distant and the view will be filtered by trees, the changes will not be discernible from the original scheme. 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.
- 5.2.71 Viewpoint 071.3.002: view north from PRoW (Footpath Col/2/2) was assessed as being affected by the original scheme and will also be affected by this amendment. The main ES reported a moderate adverse and significant effect during year 1 of operation, due to the Chalfont St Giles ventilation shaft and the associated ATS being visible in the middle ground of this elevated view (approximately 475m) but partially

screened by the field boundary vegetation along Bottom House Farm Lane. This reduced to minor adverse and not significant in year 15 and negligible in year 60. Mitigation planting will help to integrate the ventilation shaft into the existing wooded landscape. As the receptor is approximately 475m distant and the view will be filtered by trees, the changes will not be discernible from the original scheme. 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.

- 5.2.72 Viewpoint 072.2.001: view west from Bottom House Farm Lane was assessed as being affected by the original scheme, and will also be affected by this amendment. The main ES reported a moderate adverse and significant effect during year 1 of operation, due the Chalfont St Giles ventilation shaft and ATS being visible in middle ground filtered views (approximately 60m), partially screened by the earthworks immediately surrounding the ventilation shaft area. This reduced to minor adverse and not significant in year 15, and negligible in year 60, as the proposed mitigation planting and existing vegetation will further screen views of the ventilation shaft headhouse and auto-transformer feeder station. Although the height of the structures will be increased by 2m from the original scheme, views will be filtered by existing trees, and will not alter the predicted magnitude of change for the original scheme. 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.

Mitigation and residual effects

- 5.2.73 No additional mitigation measures (i.e. in addition to those identified in the main ES) are required. The amendment will result in no change in the likely residual significant effects reported in the main ES.

Cumulative effects

- 5.2.74 There are no new or different likely significant cumulative effects for landscape or visual assessment as a result of the AP4 amendments interacting with one another, or any relevant committed development.

Water resources and flood risk assessment

Introduction

- 5.2.75 This section of the report describes the environmental baseline in relation to water resources and flood risk assessment 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

- 5.2.76 The assessment scope, key assumptions and limitations for the water resources and flood risk assessment are as set out 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.

- 5.2.77 The assessment has taken account of changes in relevant legislation published since the main ES was produced, such as the Water Act 2014 and the Environmental Permitting (England and Wales) Regulations amendment 2014.
- 5.2.78 The effects related to the works at the Chalfont St Peter ventilation shaft and ATS and Chalfont St Giles ventilation shaft and ATS and the extension of the bored tunnel have been scoped in for water resources and flood risk assessment.

Existing baseline

- 5.2.79 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, CFA8, Section 13.3 and in Volume 5 of the main ES.
- 5.2.80 In this area, the route passes below the high-value receptor of the River Misbourne, a main river classified under WFD (water body reference GB106039029830) as poor potential, with the objective of achieving good potential by 2027. At the HS2 route crossing point the River Misbourne forms an in line lake called Shardeloes Lake.
- 5.2.81 The bedrock geology underlying the route, as mapped by the British Geological Survey, is Cretaceous White Chalk, comprising Seaford Chalk Formation and Newhaven Chalk Formation (at the Chalfont St Peter ventilation shaft site), Lewes Nodular Chalk Formation (at the Chalfont St Giles ventilation shaft site), and New Pit Chalk Formation and Holywell Nodular Chalk Formation (in the area of the tunnel vertical realignment).
- 5.2.82 The Cretaceous Chalk is classified as a Principal aquifer, and forms the Mid-Chilterns Chalk groundwater body (water body reference GB40601G601200) in this area. Under the WFD, the Mid-Chilterns Chalk is classified as having Poor status, with the objective of reaching Good status by 2027. The Chalk aquifer is assessed to be a high- to very high-value receptor.
- 5.2.83 At the Chalfont St Giles ventilation shaft site, the Chalk is overlain by superficial deposits, specifically the Beaconsfield Gravel, River Terrace Deposits. At the tunnel vertical realignment area, which is located in the valley of the River Misbourne, the Chalk is overlain by superficial deposits comprising Alluvium. The River Terrace Deposits and Alluvium are both classified as Secondary A superficial aquifers. No superficial deposits are present at the Chalfont St Peter ventilation shaft and ATS site.
- 5.2.84 Further details regarding the geology can be found in Volume 2, Appendix WR-002-010 of the main ES.
- 5.2.85 Since the submission of the main ES, the Environment Agency has updated the SPZs for the PWS in the Chilterns area. The updated zones show that the Chalfont St Giles and Chalfont St Peter ventilation shaft sites are now located in SPZ2 (for THo27 and THo28 respectively). In both cases, the abstraction source is located more than 5km down-gradient of the ventilation shaft site. In addition, the tunnel route now crosses SPZ1 and SPZ2 for the PWS THo11. The route crosses SPZ1 (see grid reference C5 in SES3 and AP4 Volume 5 Water Resources and Flood Risk Assessment Map Book, WR-

02-008) and SPZ2 (see grid reference B5, C5, D5 in SES3 and AP4 Volume 5, Water Resources and Flood Risk Assessment Map Book, WR-02-008). The route is located approximately 2.5km up-gradient of source for the PWS TH011 at the location where is the route crosses SPZ1.

- 5.2.86 There are no licensed or reported private unlicensed groundwater abstractions within 1km of the amendment. There is the potential for further unlicensed abstractions to exist, as a licence is not required for abstraction volumes below 20m³ per day.
- 5.2.87 There are five discharges to groundwater within 1km of the amendment. Full details are set out in main ES Volume 5: Appendix WR-002-010 Table 4.
- 5.2.88 The regional hydrogeological map shows that groundwater flow is generally to the south-east in CFA8. There is also a localised pattern of groundwater flow towards the River Misbourne when groundwater levels are high, and groundwater flow away from the location of the River Misbourne during dry periods when groundwater levels are low.
- 5.2.89 The Environment Agency borehole monitoring data indicates that maximum recorded groundwater levels were measured in winter, year 2000/1 at 67m above ordnance datum (AOD) at Chalfont St Peter, rising to 97m AOD at the boundary between CFA8 and CFA9. The tunnel elevation will be between 37.6m AOD near Chalfont St Peter, 59.8m AOD near Amersham and 78.1m AOD near Little Missenden.
- 5.2.90 The data suggests that groundwater levels will be above the tunnel elevation at all times. Peak groundwater levels will be approximately 20–30m above the tunnel elevation.
- 5.2.91 The route will cross a number of dry valleys within this area. The dry valleys are shown on the updated Flood Map for Surface Water (uFMfSW) to be at risk of surface water flooding. As the AP4 revised scheme comprises mainly tunnel within CFA8, the surface water flood risk has only been considered at the locations of permanent above-ground infrastructure. The dry valleys of greatest significance in relation to the AP4 revised scheme are located as follows:
- at the Chalfont St Giles ventilation shaft. The permanent structure of the ventilation shaft, and its associated access hard-standing and landscaping, will intersect a dry valley shown on the uFMfSW to be at risk of surface water flooding in the 1 in 30 year return period (3.3% annual probability) rainfall event; and
 - immediately to the south and east of the Amersham ventilation shaft. The ventilation shaft itself and associated construction site do not lie within the area of a dry valley, and no changes are proposed to the scheme which would result in changes to the effects identified in the main ES. As a result, the Amersham ventilation shaft is not considered further with regard to flood risk.
- 5.2.92 The AP4 revised scheme passes beneath the River Misbourne and areas of Flood Zone 2 and Flood Zone 3, as well as the area shown to be at risk of flooding in the event of

failure of the embankment forming Shardeloes Lake as described in the main ES. However, there are no changes to above-ground works within the area at risk from rivers or reservoir failure within CFA8. As a result, river flooding is not considered any further within the study area. There will be no change to the scheme in the area surrounding Shardeloes Lake which could affect the stability of the embankment. Therefore, this source of flooding is not considered further.

- 5.2.93 There are no significant risks of flooding from sewers 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)

- 5.2.94 The future baseline for construction in 2017 remains unchanged from that reported in the main ES (Volume 2, CFA8, Section 13.3).

Operation (2026)

- 5.2.95 Current projections to the 2080s indicate that climate change may affect the future baseline against which the impacts of the AP4 revised scheme on surface water and groundwater resources have been assessed. There may be changes in the flow and water quality characteristics of surface water and groundwater bodies as a result of changes in climate. However, except for flood flows, 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.
- 5.2.96 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.
- 5.2.97 The future baseline for operation in 2026 remains unchanged from that reported in the main ES (Volume 2, CFA8, Section 13.3).

Effects arising during construction

- 5.2.98 This amendment will include the lowering of the vertical alignment of the tunnel by up to 1m between the point where the route passes below the River Misbourne and the boundary of the CFA (see grid reference C4, SES3 and AP4 Volume 5 Water Resources and Flood Risk Assessment Map Book, WR-02-008). In this area, the amendment passes through SPZ1 of the PWS TH011. As set out in Section 3.2, the impact of tunnelling through SPZ1 is assessed to be major with a very large effect and therefore significant. The change in the vertical alignment will not affect this assessment, and impact and the effect will remain as very large and therefore significant.
- 5.2.99 In the area of the vertical realignment, the tunnel also passes beneath the River Misbourne, in the vicinity of Shardeloes Lake. Where the tunnel passes under the Misbourne, there could be the potential for ground settlement to occur during or soon after construction. Ground settlement could locally increase vertical permeability by activating fractures in the bed of the river. In the main ES it was assessed that although the value of the River Misbourne is high, the risk of this impact occurring is

low, given the limited extent over which it might occur, and the tunnelling methodology proposed. The change in vertical alignment at the point where the tunnel passes under the River Misbourne is minor. Therefore the predicted settlement contours for the revised scheme are identical to those in the original scheme. The assessment, impact and effect will remain as reported in the original ES, negligible with neutral effect, and therefore not significant.

- 5.2.100 Construction of the ventilation shafts at Chalfont St Giles and Chalfont St Peter will take place in SPZ₂ for two PWS abstractions (THo₂₇ and THo₂₈ respectively). Underground works including tunnelling, piling and construction of diaphragm walls can affect groundwater quality, and, hence, can affect groundwater sources. The main concerns are considered to be contamination arising from loss of circulation fluid, turbidity resulting from the breakdown of in-situ aquifer material, and possible contamination by hydraulic fluids and greases from machinery.
- 5.2.101 In both cases, the sources, THo₂₇ and THo₂₈, are substantial distances (over 5km) down-gradient from the area where the route crosses the SPZs which provides groundwater to the sources. As a result of natural attenuation, the impacts from construction of the ventilation shafts for the original scheme on the sources THo₂₇ and THo₂₈, were assessed to be negligible, resulting in neutral and non-significant effects. The changes at the two ventilation shaft sites in this amendment (construction of additional tunnel cooling equipment and accompanying electrical switchgear) will not increase the risk to THo₂₇ and THo₂₈. The impact on THo₂₇ and THo₂₈ will remain negligible as reported in the main ES, resulting in neutral and not significant effects.
- 5.2.102 Construction of the additional tunnel cooling equipment (chillers) and accompanying electrical switchgear (chiller plant) at the Chalfont St Giles and Chalfont St Peter ventilation shafts will be surrounded by two land drainage areas, which will remove any surface water run-off from the hardstanding areas within the ventilation shaft compounds. The run-off will infiltrate through the drains to the unsaturated zone above the Chalk aquifer and percolate down to the Chalk water table. However, the volume of water captured at these sites will be very small when compared to total infiltration to the aquifer and contamination from surface infiltration at all ventilation shaft construction sites will be prevented through the requirements of the draft CoCP, (Volume 5: Appendix CT-000-003 of the main ES) Section 16. Therefore, the impact due to the drainage remains as negligible, as reported in the main ES, with neutral effect and therefore not significant.
- 5.2.103 The changes related to the Chilterns tunnel extension (including changes at the Chalfont St Giles and Chalfont St Peter ventilation shaft sites, and the minor vertical realignment of the tunnel close to the boundary with CFA₉) will not give rise to any new or different significant effects during construction. The changes will not alter the level of significance of the effects reported in SES₃.

- 5.2.104 Landscape earthworks around the proposed ventilation shaft at Chalfont St Giles have been designed to reprofile the dry valley. The earthworks have been designed to ensure that overland flow paths are maintained to the downstream catchment, and the ventilation shaft is not at risk of flooding. The site-specific flood risk management plans required under Section 16 of the draft CoCP will take into account the reprofiling. The plan will be used to manage potential flood risks in order that there will be no impact on the risk of flooding elsewhere as a result of construction of the AP4 revised scheme.
- 5.2.105 As a result, no significant increases in flood risks from all sources during the construction process are identified. Therefore no significant effects are expected as a result of the amendment.
- 5.2.106 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 or Part 1 of the SES3 and AP4 ES.

Effects arising from operation

- 5.2.107 The Chilterns 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 or Part 1 of the SES3 and AP4 ES.

Mitigation and residual effects

- 5.2.108 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.
- 5.2.109 In accordance with Section 16 of the draft CoCP, excavated material storage, construction compounds, and site offices will be located outside of areas at risk of flooding where 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 Chalfont St Giles ventilation shaft construction compound, there will be a site-specific flood risk management plan prepared prior to construction.
- 5.2.110 No additional mitigation measures (i.e. in addition to those identified in the main ES and subsequent SES reports) are required.
- 5.2.111 There are no new or different residual significant effects for water resources or flood risk as a result of the amendment. The residual significant effects are the same as reported in the main ES and Part 1 of the SES3 and AP4 ES.
- 5.2.112 HS2 Ltd is working closely with Affinity Water to review the potential effects on water supply. The range of mitigation options include the importation of water from neighbouring water companies, and the temporary provision of additional treatment at Affinity Water sources. This latter option is included in AP4-007-003 (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 significant temporary residual effect on the Affinity Water groundwater abstractions.

Cumulative effects

- 5.2.113 There are no new or different likely significant cumulative effects for water resources or flood risk as a result of the AP4 amendment interacting with one another or any relevant committed development.

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

- 5.2.114 The proposed changes in CFA8 associated with the extension of the Chiltern tunnel from Mantle's Wood portal to South Heath green tunnel north portal (AP4-009-001) 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.

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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Z14