A303 Amesbury to Berwick Down

TR010025

6.1 Environmental Statement

Chapter 8: Biodiversity

Volume 6

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

October 2018

8 Biodiversity

8.1 Introduction and competent expert evidence

8.1.1 This chapter assesses the potential impacts on biodiversity from the construction and operation of the Scheme, following the methodology set out in Design Manual for Roads and Bridges ("DMRB") Volume 11, Section 3, Part 4 (Ref 8.1) and associated Interim Advice Notes ("IANs") (Ref 8.2). This chapter details the methodology followed for the assessment, summarises the regulatory and policy framework related to biodiversity and describes the existing environment in the area surrounding the Scheme. Following this, the design, mitigation and residual effects of the Scheme are discussed, along with the limitations of the assessment.

8.1.2 This chapter of the ES has been undertaken by competent experts with relevant and appropriate experience. The technical lead for the biodiversity assessment is Stephanie Peay and her professional qualifications and experience are summarised in Appendix 1.1.

8.2 Legislative and policy framework

8.2.1 The following international agreements, European Directives and UK legislation are applicable:

a) The Wildlife and Countryside Act 1981 (as amended);

b) The Protection of Badgers Act 1992;

c) The Hedgerows Regulations 1997;

d) The Countryside and Rights of Way (CRoW) Act 2000;

e) The Natural Environment and Rural Communities Act 2006;

f) The Conservation of Habitats and Species Regulations 2017;

g) Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora (1992);

h) Council Directive 2009/147/EC on the Conservation of Wild Birds (2009);

i) The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017;

j) The Ramsar Convention 1976.

8.2.2 As discussed in Chapter 1 (Introduction), the primary basis for deciding whether or not to grant a Development Consent Order (DCO) is the National Policy Statement for National Networks (NPSNN) which, at Sections 4 and 5, sets out policies to guide how DCO applications will be decided and how the impacts of

national networks infrastructure should be considered. Table 8.1 identifies the NPSNN policies relevant to biodiversity and ecological conservation, as referred to in the NPSNN. A range of terms is used in other policies and relevant documents. The main terms used in this ES chapter are biodiversity features and conservation of biodiversity. The latter is taken to include maintenance of the ecological processes that support biodiversity in ecosystems and ensure the ecological integrity (extent and ecological functioning) of sites or the features for which the sites were designated as being important for conservation of biodiversity. Table 8.1 shows where in this ES chapter information is provided to address the NPSNN policies.

Table 8.1: Relevant NPSNN policies for Biodiversity assessment

Relevant NPSNN paragraph reference	Requirement of the National Policy Statement for National Networks (NPSNN)	Where in the ES Chapter is information provided to address this policy.
4.22 and 4.25	NPSNN describes the need under the Habitats Regulations to consider whether the Scheme could have a significant effect on the objectives of a European site and the procedure to be followed.	An assessment of the likely significant effects on European Sites has been undertaken in Appendix 8.24.
5.22, 5.26 - 5.32 and 5.35	NPSNN Section 5: Biodiversity and ecological conservation, describes the process of EIA and the need to assess any likely significant effects on all of the following: internationally, nationally and locally designated sites of importance for the conservation of biodiversity, protected species and habitats and other species identified as being of principal importance for the conservation of biodiversity and the full range of potential impacts on ecosystems.	The assessment of effects on all biodiversity receptors is detailed in Section 8.9 and a summary of non-significant effects is provided in Appendix 8.23
5.23	NSPNN gives guidance on the principles that should be applied in the EIA and design development, including avoiding adverse impacts on sites, species and habitats (outlined in 5.22); providing appropriate mitigation measures as an integral part of a development and taking advantage of opportunities to conserve and enhance biodiversity features in and around development.	Section 8.8 outlines the design, mitigation and enhancement measures incorporated in the Scheme

Policy

8.2.3 Other policies have been considered as part of the biodiversity assessment where these have informed the identification of biodiversity features (any designated sites of importance for nature conservation, habitats and species populations that may be affected by impacts of the Scheme); the assessment methodology; the potential for significant environmental effects, mitigation for

impacts, and enhancement to be provided by the Scheme. These policies include those as detailed below.

National Planning Policy Framework (NPPF)

8.2.4 The NPPF adopted in 2012 and revised in 2018 sets out the Government's planning policies for England. In accordance with the NPPF, the NPSNN policies relating to the applicant's assessment are the primary source of policy guidance regarding this assessment. The NPPF provides policy guidance for the development of local plans, which are taken into account in the assessment.

8.2.5 The NPPF 2018 contains similar provisions to the NPSNN but in biodiversity in Section 15: Conserving and enhancing the natural environment. A notable change in the NPFF is the removal of reference to 'avoiding net loss of biodiversity' and inclusion of 'minimising impacts and providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures'.

8.2.6 Paragraph 171 states that plans should: distinguish between the hierarchy of international, national and locally designated sites; allocate land with the least environmental or amenity value; take a strategic approach to maintaining and enhancing networks of habitats and green infrastructure; and plan for the enhancement of natural capital at a catchment or landscape scale.

8.2.7 Whilst the mitigation hierarchy of avoid, mitigate, compensate remains in the NPPF, the revised wording encourages developers to look beyond maintaining existing biodiversity value. Instead it actively encourages provision of additional benefits for biodiversity which contribute to future-proofing the natural environment.

Wiltshire Core Strategy 2015

8.2.8 Relevant policies relating to biodiversity in the adopted Wiltshire Core Strategy 2015 are in accordance with the NPPF and aim to protect important ecological (biodiversity) features where possible. They include:

a) Core policy 50 (Biodiversity and geodiversity): which expects developments to protect features of importance and states these should be retained, buffered and managed to maintain their ecological value, connectivity and functionality in the long term. Where this cannot be achieved, the policy states that impacts should be mitigated as far as possible and measures should be secured to ensure no net loss of biodiversity resource and secure local ecological networks. It requires developments to avoid any adverse effect on the integrity of a Natura 2000 (European designated) site.

b) Core policy 57 (Ensuring high quality design and place shaping): promotes retention and enhancement of existing important landscaping and natural features such as trees, hedges and watercourses and the creation of wildlife and recreational corridors.

c) Core policy 69 (protection of the River Avon SAC): identifies the River Avon Special Area of Conservation as a potential sensitive receptor which requires protection from adverse pollution impacts resulting from development. The policies also encourage mitigation of pollution on the water environment through careful design to facilitate good pollution control practice.

Other relevant documents

The Natural Environment White Paper (2011)

8.2.9 The paper set out a framework for protecting and enhancing the natural environment, to be backed up with targets for practical action to halt the loss of UK and International species and habitats. It set out themes towards:

a) facilitating greater local action to protect and improve nature;

b) creating a green economy in which economic growth and the health of our natural resources sustain each other, and markets, business and Government better reflect the value of nature;

c) strengthening the connections between people and nature to the benefit of both; and

d) showing leadership in the European Union and internationally, to protect and enhance natural assets globally.

The UK Post-2010 Biodiversity Framework 2012

8.2.10 The UK Post-2010 Biodiversity Framework was published on 17 July 2012. It was produced by Joint Nature Conservation Committee (JNCC) and Defra, on behalf of the Four Countries' Biodiversity Group (4CBG), through which the environment departments of all four governments in the UK work together.

Biodiversity 2020: A Strategy for England's Wildlife and Ecosystem Services

8.2.11 This document sets out the strategic direction for biodiversity policy up to 2020 based around four thematic areas: a more integrated large-scale approach to conservation on land and at sea; putting people at the heart of biodiversity policy; reducing environmental pressures; and improving scientific knowledge.

A Green Future: A 25 Year Plan to Improve the Environment

8.2.12 Defra's 25 year environment plan (Ref 8.3) contains the following targets:

a) Restoring 75% of our one million hectares of terrestrial and freshwater protected sites to favourable condition, securing their wildlife value for the long term.

b) Creating or restoring 500,000 hectares of wildlife-rich habitat outside the protected site network, focusing on priority habitats as part of a wider set of land management changes providing extensive benefits.

c) Taking action to recover threatened, iconic or economically important species of animals, plants and fungi, and where possible to prevent human induced extinction or loss of known threatened species in England and the overseas territories.

Our plan to protect and increase biodiversity (2015)

8.2.13 Highways England's biodiversity plan: 'Our plan to protect and increase biodiversity' states that: "by 2020, the company must deliver no net loss of biodiversity, and that by 2040 it must deliver a net gain in biodiversity". Highways England will contribute to government strategy for biodiversity by delivering:

a) landscape scale biodiversity projects that reduce habitat fragmentation;

b) new projects which enhance biodiversity value of land and therefore reduce their impacts;

c) an increased number of Sites of Special Scientific Interest which are in favourable or recovering condition;

d) managed woodland areas that are meeting their intended purpose: landscape screening, connectivity or biodiversity;

e) grassland areas that are managed appropriately with litter and debris removed;

f) 3500 hectares of grassland rich in wildflower species and therefore supporting a wide range of pollinating insects.

The National Pollinator Strategy: for bees and other pollinators in England (2014)

8.2.14 Highways England has committed to the following within the National Pollinator Strategy: Highways England will undertake a programme of works to restore and enhance the grassland component of the soft estate (e.g. verges, embankments) to achieve a significant area of species rich grasslands estimated at 3,500 hectares by 2021.

Wiltshire Biodiversity Action Plan (2008)

8.2.15 The Wiltshire Biodiversity Action Plan sets out the actions needed for protecting and enhancing wildlife in Wiltshire. The Plan focuses on landscape and ecosystem scale areas, to identify the habitats, environmental pressures and conservation activities in these areas to establish a resilient ecological network of habitats. As part of the actions undertaken following this Biodiversity Action Plan, selection criteria were developed for County Wildlife Sites in 2013 and these have been used in evaluating biodiversity features.

8.3 Assessment methodology

8.3.1 An assessment of likely biodiversity impacts associated with the Scheme was undertaken in accordance with the Ecological Impact Assessment guidelines published by the Chartered Institute of Ecology and Environmental Management (CIEEM) (Ref 8.4) and guidance provided in Highways England's IAN 130/10 (Ref 8.2) which is a component part of the DMRB. The method is described in paragraphs 8.3.2 - 8.3.11.

8.3.2 The CIEEM approach to assessment has several stages:

a) scoping;

b) establishing the baseline and evaluating the importance of biodiversity features (described as determining the importance of ecological features in CIEEM guidance); and

c) impact assessment and identification of significant effects.

8.3.3 The importance (conservation value) of biodiversity features (designated sites, habitats, species assemblages and populations of species) is evaluated in Section 8.6. Importance is assessed with reference to their nature conservation status (i.e. rarity, threat status); their conservation value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations); and legal status. A review of the legislation, policy and the sensitivity of the biodiversity features has been undertaken and the importance of the biodiversity features was determined in a geographical context on the following basis:

a) International and European;

b) National (England);

c) Regional (South West England);

d) County (Wiltshire);

e) Local; and

f) Site (below Local).

8.3.4 A number of characteristics are considered to contribute to the importance of biodiversity features including, for example (but not exclusively), the rarity of a species or habitat, habitat diversity, whether the species population size is notable in a wider context, rich assemblages of plants and animals and species on the edge of their range, particularly where their distribution is changing as a result of global trends and climate change.

8.3.5 Conservation value does not necessarily equate directly to sensitivity, as a biodiversity feature of high conservation value may comprise a robust

ecosystem which is resilient to effects caused by external factors and therefore is not highly sensitive. Alternatively, a species may be highly sensitive to change but widespread or abundant in occurrence at the geographic scale considered and therefore the population within the study area may not be important at that scale. However, the DMRB guidance (Ref 8.1) uses the two terms interchangeably. The relationship between feature value (sensitivity) and importance, in accordance with DMRB guidance (Ref 8.2) is shown in Table 8.2. NSPNN refers to these scales and the relevant paragraphs are noted in Table 8.2.

Table 8.2: Criteria for assessing the importance of biodiversity features and relating geographic importance to value

Importance (Ref 8.4)	Conservation value (Ref 8.1 and 8-5)	Criteria from DMRB (IAN 30/10) and reference to NSPNN
International (European)	Very High	**NSPNN: (5.27) International sites** **DMRB** **Habitats:** Natura 2000 sites including: Sites of Community Importance (SCIs); Special Protection Areas (SPAs); potential SPAs (pSPAs); Special Areas of Conservation (SACs); candidate or possible SACs (cSACs or pSACs); and Wetlands of International Importance (Ramsar sites). Biogenetic Reserves, World Heritage Sites and Biosphere Reserves. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. **Species:** resident, or regularly occurring, populations of species which may be considered at an International or European level where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this geographic scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase of its life cycle at this scale.
National (England)	High	**NSPNN: (5.28) Sites of Special Scientific Interest (SSSI), (5.30) Marine Conservation Zones not present, (5.32) Irreplaceable habitats including ancient woodland** **DMRB:** **Habitats:** Designated sites including: SSSIs; Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs); and National Nature Reserves (NNRs). Areas which meet the published selection criteria for e.g. JNCC Selection criteria for SSSI (1998) for those sites listed above but which are not themselves designated as such. Areas of key/priority habitats identified in the UK Biodiversity Action Plan (BAP), including those

Importance (Ref 8.4)	Conservation value (Ref 8.1 and 8-5)	Criteria from DMRB (IAN 30/10) and reference to NSPNN
		published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity (Habitat of Principal Importance (HPI)). Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory. **Species**: resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level (Species of Principal Importance (SPI)) where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population at this scale; or • the species is at a critical phase11 of its life cycle at this scale.
Regional (South West England)	Medium	**NSPNN: (5.31) Regional and Local Sites** **DMRB:** **Habitats:** areas of key/priority habitats identified in the Regional BAP (where available); areas of key/priority habitat identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats (e.g. South West Nature Map); and areas of key/priority habitat listed within the Highways Agency's BAP. **Species**: Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/priority species listed within the HABAP where: • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.
County (Wiltshire)	Medium	**NSPNN: (5.31) Regional and Local Sites, (5.34) Protection of other habitats and species** **DMRB:** **Habitats**: Designated sites including: Sites of Nature Conservation Importance (SNCIs); County Wildlife Sites (CWSs); and Local Nature Reserves (LNRs) designated in the county context. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key/priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent).

Importance (Ref 8.4)	Conservation value (Ref 8.1 and 8-5)	Criteria from DMRB (IAN 30/10) and reference to NSPNN
		Species: Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where: • the loss of these populations would adversely affect the conservation status or distribution of the species across the County or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.
Local	Low (or Lower)	**NSPNN: (5.33) Biodiversity within and around developments** **DMRB:** **Habitats**: Trees that are protected by Tree Preservation Orders (TPOs). Areas of habitat considered to appreciably enrich the habitat resource within the local context (such as veteran trees), including features of value for migration, dispersal or genetic exchange. **Species**: Populations/communities of species considered to appreciably enrich the biodiversity resource within the local context.
Site	Less than Low	(not defined in DMRB) **Habitats**: Areas of heavily modified or managed vegetation of low species diversity, or of low value as habitat to species of importance for conservation at county or national scale that do not meet criteria for Local or higher scale. **Species**: A good example of a population of a common or widespread species.

Characterising the biodiversity impacts

8.3.6 The identification and assessment of impacts on important biodiversity features takes into account embedded mitigation or compensation measures. The Scheme incorporates mitigation which has been included as part of the design following consultation, as shown on the Environmental Masterplan (Figure 2.5) and described within the Environmental Mitigation Schedule (Appendix 2.1) and OEMP (Appendix 2.2). Where detailed assessment of specific receptors is considered appropriate, the potential impacts on these receptors are described and characterised in accordance with CIEEM 2016 (Ref 8.4) DMRB IAN 130/10 (Ref 8.2).

8.3.7 Characterisation of the impacts takes into consideration the following aspects (where appropriate):

a) positive (beneficial) or negative (adverse) impact;

b) probability of occurring (certain, probable, or unlikely);

c) complexity (direct, indirect, cumulative);

d) extent (area measures or percentage of total, such as area of habitat/ territory lost);

e) size or magnitude (description of severity of influence, such as reduction of quality of habitat or complete loss);

f) reversibility (reversible or not reversible);

g) duration (permanent or temporary in ecological terms); and

h) timing and frequency (important seasonal or life-cycle constraints and any relationship with frequency considered).

Characterising the biodiversity effects

8.3.8 The significance of effects has been assessed according to the CIEEM guidance (Ref 8.4):

> *"For the purpose of ecological impact assessment, 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features'…or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity)".*

8.3.9 Effects have been described with respect to the geographic scale at which they may be regarded as significant from international to site level.

8.3.10 Highways England IAN 130/10 (Ref 8.2) uses a slightly different terminology to CIEEM to grade the significance of impacts. However, the IAN 130/10 approach is fully compatible with the CIEEM approach and does not alter the conclusions which have been reached in this assessment using the latter method. A comparison of the approaches is detailed within Table 8.3.

Table 8.3: Relating geographic scale (Ref 8.4) to significance (Ref 8.2)

CIEEM category for impact significance (Ref 8.4)	IAN 130/10 category for impact significance (Ref 8.1 and Ref 8.2)	DMRB definition
European and national	Very large	Only adverse effects are normally assigned this level of significance. They represent key factors in the decision-making process. These effects are generally, but not exclusively, associated with sites or features of international and national importance that are likely to suffer a most damaging impact and loss of resource integrity.
Regional	Large	These beneficial or adverse effects are considered to be very important considerations and are likely to be material in the decision-making process.
County	Moderate	These beneficial or adverse effects may be important, but are not likely to be key decision-making factors. The cumulative effects of such factors may influence decision making if they lead to an increase in the overall adverse effects on a particular resource or receptor.
Local	Slight	These beneficial or adverse effects may be raised as local factors. They are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Effects on features below the local level.	Neutral	No effects or those that are beneath levels of perception, within normal bounds of variation or within the margin of forecasting error.

8.3.11 For the purposes of this EIA an effect is considered to be significant if it has a Moderate effect (county level) or greater.

Scoping

8.3.12 A request for an EIA Scoping Opinion was sent to the Inspectorate in relation to the Scheme in October 2017, presenting the proposed scope of work and methodology for the EIA. Table 8.4 summarises the points raised in the Inspectorate Scoping Opinion regarding biodiversity and where assessment has been undertaken in accordance with the Scoping Opinion point, a response and the relevant ES section is provided; where an alternative approach was agreed with the relevant stakeholder, an explanation is provided. The Scoping Opinion as received is provided in Appendix 4.1.

Table 8.4: Scoping Opinion and response

Scoping opinion/ theme	Response and location addressed within the ES
The Inspectorate	
The Inspectorate suggests that targeted surveys should be undertaken within suitable reptile habitat to confirm their presence/absence in order to establish the potential for significant effects to occur.	A habitat assessment update was undertaken in 2018 of all areas within 200m of the Scheme boundary, as set out in Table 8.8. The potential for impacts on reptiles is set out in paragraphs 8.9.109-8.9.118 and 8.9.210, with proposed mitigations set out in Section 8.8 and discussed further in the OEMP.
The Inspectorate proposes that the need for wintering bird surveys is discussed and agreed with Natural England. If these surveys are required, they should be undertaken in accordance with recognised good practice.	As discussed with The Inspectorate at a post-Scoping Opinion meeting on January 30th 2018, Natural England was consulted on the requirements for additional wintering bird surveys. It was proposed that the records provided by the Wiltshire Ornithological Society were sufficient to inform the assessment, a position that was agreed with Natural England on June 13th 2018. This approach was discussed and agreed with Wiltshire Council Ecologist on 5th July 2018. The assessment of the potential for effects on wintering birds is set out in paragraphs 8.9.119-129 and 8.9.211-8.9.214
The Inspectorate suggests that the study area for designated sites should be determined in relation to the potential ZoI of the Scheme.	Agreed. The study area is dependent on the biodiversity receptor in question (as it varies dependent on factors such as their sensitivity and distribution range). The extent of each study area for each biodiversity receptor is described in Section 8.5 and set out in Table 8.6 and Table 8.7 of the ES.
The inspectorate recommends that the study area should be further defined through appropriate survey, including additional phase 1 habitat survey(s). The ES should include justification ensuring that all potential impacts within the study area have been assessed.	Additional phase 1 habitat surveys were undertaken to inform the EIA. The biodiversity methodology and study area are discussed in Sections 8.3 and 8.5, respectively, and the baseline is presented in Section 8.6.
The Inspectorate suggests that specific reference should be made to the effects of noise and vibration associated with the tunnel boring machine and the long term operation of the bored tunnel on biodiversity receptors.	The ecological impact assessment considers the potential for noise and vibration impacts from all sources associated with the construction and operation of the Scheme. Any potential effects are set out in paragraph 8.9.35, no further biodiversity features are expected to be affected.
The Inspectorate outlines that further information is required to inform the noise and vibration impacts on fish and other species that may be present within the River Avon SAC.	As discussed with The Inspectorate at a post-Scoping Opinion meeting on January 30th 2018, there will be no piling works within the channel of River Till (or Avon). The Till is winterbourne at the crossing and so unsuitable for salmonid spawning, hence, would not be disturbed by noise and vibration. Fish diversity and abundance were found to be poor in the affected section and upstream due to winterbourne status. Fish are only present in late winter to early summer, i.e.

Scoping opinion/ theme	Response and location addressed within the ES
	transient. There would be certainty of no impact if work is carried out when the Till is dry. Even if work is done in spring it is unlikely that bridge piling would need to be seasonally constrained because fish populations are expected to be small. It is unlikely that piling in this location would result in significant effects occurring in relation to fish species. The potential for impacts on the River Avon SAC and fish are set out paragraph 8.9.17.
The Inspectorate recommends that the scope of targeted species surveys are discussed and agreed with relevant statutory bodies to ensure comprehensive coverage. The ES should include a description of reasons for the targeted surveys required and should confirm the survey dates and duration as well as spatial scope.	The scope of targeted species surveys has been discussed with relevant statutory and, where relevant, non-statutory bodies. The ES includes a description of reasons for the targeted surveys including their survey dates, duration and spatial scope, see Section 8.5. A summary of consultation and engagement with environmental statutory and non-statutory bodies is given in Section 8.3.
The Inspectorate recommends that the ES should include a clear description of the assessment methods(s) including the approach to determining significance and explain how IAN 130/10 and the CIEEM guidance have both been used. The ES should also confirm if/ where professional judgement has been used.	A clear description of methods used is provided in Section 8.3.
The Inspectorate advises that the HRA must be co-ordinated with the EIA, to avoid duplication of information between assessments.	The HRA has been coordinated with the EIA, Appendix 8.24.
Natural England	
Natural England advised that stone curlew data should be obtained and used in the environmental assessment.	Data on stone curlew nest sites has been provided by RSPB and is not limited to Normanton Down. Baseline information is set out in Table 8.12 and Appendix 8.1B. Potential impacts and the proposed mitigation for stone curlew have been addressed for all areas subject to disturbance from the Scheme and are discussed in paragraphs 8.9.27–8.9.30, 8.9.33 - 36, and 8.9.187.
Natural England advised that the effects of change of hydrological regime in the River Avon should be assessed and data obtained for this.	The potential for changes to the hydrological regime of the River Avon are discussed in detail in Appendix 11.2 (WFD Impact Assessment) and Appendix 11.4 (GRA). The potential implications of changes to the hydrological regime on ecology are discussed in paragraph 8.9.16.
Environment Agency	
The Environment Agency advised that the ZoI at river crossings should consider the potential to affect fish moving through the construction area to	The area surveyed also extends upstream of the Scheme on both rivers, as described in paragraph 8.5.4. Fish movement will not be impeded by the scheme.

Scoping opinion/ theme	Response and location addressed within the ES
reaches upstream.	
The Environment Agency required more clarification as to where the core survey areas were and suggested that surveys were undertaken upstream of the proposed works area as well, if not included already.	Surveys were undertaken along six 500m reaches within the River Avon and the River Till, extending approximately 1km upstream and 2km downstream from the current A303 crossing of the River Avon and approximately 0.5km upstream and 2.5km downstream from the proposed River Till crossing, as described in Section 8.5
The Environment Agency recommended that the environmental assessment should consider the potential impact of noise and vibration from piling to affect fish and that mitigation measures during construction should be considered.	There will be no piling works within the channel of River Till (or Avon). The Till is winterbourne at the crossing and so unsuitable for salmonid spawning, hence, would not be disturbed by noise and vibration. Fish diversity and abundance were found to be poor in the affected section and upstream due to winterbourne status. Fish are only present in late winter to early summer, i.e. transient. There would be certainty of no impact if work is carried out when the Till is dry. Even if work is done in spring it is unlikely that bridge piling would need to be seasonally constrained because fish populations are expected to be small. It is unlikely that piling in this location would result in significant effects occurring in relation to fish species. The potential for impacts on the River Avon SAC and fish are set out in paragraph 8.9.17

Consultation

8.3.13 Consultation has been undertaken with key biodiversity stakeholders including Natural England, Wiltshire County Council, the Royal Society for the Protection of Birds (RSPB), the Environment Agency, National Trust and the Wiltshire Chalk Grassland Group (a broad group of biodiversity stakeholders, including Natural England, RSPB, Wiltshire Wildlife Trust, Plantlife, Butterfly Conservation and various individual specialists). These consultations have served to inform the scope of studies, the scope of the ecological assessment, the Scheme design and opportunities for mitigation and enhancement. The key biodiversity consultees were provided with draft copies of the baseline survey reports to help inform the process of consultation. Full information is provided in the Consultation Report (Application Document 5.1) and a summary of the key outcomes is provided in Table 8.5.

Table 8.5: Stakeholder consultations on biodiversity

Stakeholder	Meeting dates	Summary of outcome of discussions
Natural England	Various 2017-2018	Meetings and telephone calls to discuss the best possible methods for creating habitats and ecological networks through habitat creation within the Scheme. Advice on species licence requirements and Habitat Regulations Assessment. Proposed mitigation/ compensation measures for stone curlew. Ongoing consultation has been undertaken with natural England via the Discretionary Advice Service (DAS).
RSPB	Various 2017-2018	Data provision, potential opportunities for biodiversity mitigation and enhancement measures that could be incorporated into the design; habitat creation and mitigation for stone curlew.
Wiltshire County Council	Various 2017-2018	Suitable mitigation, including measures to avoid or mitigate impacts on bats, and provide ecological networks, comprising a mosaic of habitats on chalk and the need for effective long term management.
Wiltshire Chalk Grassland Group	13/12/17, 06/03/18	Opportunities for biodiversity; ecological network and the potential for interaction between the Scheme and other areas, connectivity and biodiversity objectives for types of habitats, design considerations, roles of stakeholders.
National Trust	Various 2017-2018	Opportunity for offsite (outside Scheme boundary) replacement tree-planting for landscape-scale mitigation for bats and habitat creation on existing A303 which is being converted to a bridleway and cycleway.
Environment Agency	Various 2017-2018	River Till crossing design and mitigation measures during construction, including avoidance of siltation and any potential disturbance from piling on fish species. Data provision of otter road casualties and macroinvertebrate data.
Bustard Group	25/10/17, 2/11/17	Re-introduction programme, data provision and discussion of potential for disturbance.
Landowners Various	2017	Issues associated with stone curlew disturbance and management, public access to land south of A303.

8.4 Assessment assumptions and limitations

8.4.1 Data provided by biological records centres' is often subject to the spatial coverage of biodiversity recording schemes, many of which are not carried out in a systematic way. This data frequently does not include negative survey data (data showing where surveys have occurred and species absence has been proven likely). In particular, certain areas (e.g. nature reserves) have been heavily recorded whereas other areas (e.g. private farmland) have not been well studied. For this reason, the absence of desk study records for a species has not been taken to indicate species absence. Desk study records have been used alongside habitat data and the known/anticipated species distributions to infer whether these species may be present. The desk study has been used to inform the field survey scope and has been subsequently updated by the field surveys.

8.4.2 Field survey limitations are stated within the individual technical reports in Appendix 8.2A–8.23.

8.4.3 Mitigation measures are described in Section 8.8 and details and plans are provided in the accompanying Environmental Masterplan (Figure 2.5), Environmental Masterplan Mitigation Schedule (Appendix 2.1) and OEMP. The final environmental design may alter slightly during the detailed design prior to construction. However, the impact assessment has taken account of the worst case scenarios and mitigation measures are included within the Scheme design accordingly.

8.5 Study area

8.5.1 The study area was defined to include biodiversity features likely to be at risk from possible direct and indirect impacts that might arise from the Scheme, termed the Zone of Influence (ZoI). The potential ZoI is considered to be:

a) areas of direct land take required as part of the Scheme, including temporary works such as access and utilities;

b) areas of habitat that would be affected during construction;

c) biodiversity features that could be affected by changes in conditions, such as water regime;

d) areas where there is a risk of indirect impacts such as pollution, emissions to air and water, and disturbance impacts such as increased noise and vibration levels that may occur during both the construction and operation phases.

8.5.2 The study area includes the Scheme in its entirety and includes construction compounds, areas for landscaping and habitat creation and extends beyond the Scheme boundary to encompass all the areas potentially within the ZoI for impacts from the Scheme.

8.5.3 The ZoI differs for each biodiversity feature and the impacts considered. For designated sites the ZoI is dependent on the reasons for its designation. Statutory designated sites including Special Areas of Conservation (SAC), Special Protected Areas (SPA), Ramsar sites, Sites of Special Scientific Interest (SSSI) and National Nature Reserves (NNR) were considered up to 2km from the Scheme boundary. This study area was extended to 30km for all statutory designated sites where bats were a qualifying feature of its designation, in accordance with DMRB guidance (Ref 8.1). In addition, any SSSIs (designated due to the biological features they support) were considered where their impact zones, as defined by Natural England, extended into the Scheme boundary. Sites designated at a local level (Local Nature Reserves (LNR)), non-statutory designated sites (County Wildlife Sites (CWS)), ancient woodlands and RSPB reserves were considered up to 500m from the Scheme boundary.

8.5.4 The ZoI for protected and notable species and habitats considers the direct effects of habitat loss due to the construction of the Scheme and potential indirect impacts, such as severance of territories or routes of dispersal. As such, the extent of the ZoI varies according to species and habitats. The ZoI for watercourses was extended up to 2km downstream, due to the potential for longer range changes in water quality and the sensitivity of the species and habitats present and up to 1km upstream to consider the passage of fish. The ZoI for each biodiversity feature is in accordance with DMRB and CIEEM guidance (Ref 8.1, 8.2 and 8.4).

8.5.5 A desk study was carried out, followed by field studies. Definition of the desk and field study areas follows available guidance provided in the DMRB (Ref 8.1 and 8.2) and other sources of survey good practice referenced in Appendix 8.2A-8.23. The study area for the desk study and a summary of data sources are shown in Table 8.6. Additional details of the desk study data sources are given in the methods section below and in Appendix 8.1.

Table 8.6: Desk study area and data sources

Biodiversity feature	Study area	Data sources	Date updated
International statutory nature conservation designations (SAC, SPA and Ramsar)	Up to 2km from the Scheme boundary	Multi-Agency Geographic Information for the Countryside (MAGIC) website	20/04/2018
SACs designated for bats	30km from the Scheme boundary	MAGIC and Natural England website	20/04/2018
National statutory nature conservation designations (SSSI and NNR).	Up to 2km from the Scheme boundary	MAGIC and Natural England website	20/04/2018
Local statutory nature conservation designations (LNRs), non-statutory nature conservation designations (CWSs) and nature reserves.	Up to 500m from the Scheme boundary	Wiltshire and Swindon Biological Records Centre (WSBRC) and MAGIC website	20/04/2018
Protected and notable habitats (HPIs)	Up to 500m from the Scheme boundary	WSBRC and MAGIC website	20/04/2018
Protected and notable species	Up to 2km from the Scheme boundary (up to 10km for stone curlew data)	WSBRC, Ancient Woodland Inventory for England and MAGIC website, RSPB, Wiltshire Ornithological Society, Environment Agency, The Great Bustard Group	28/04/2018
Water bodies	Up to 500m from the Scheme boundary	1:25,000 Ordnance Survey maps, Aerial photography and MAGIC and website	10/02/2018

Desk study method

8.5.6 A biodiversity desk study was carried out in 2016 and 2017 and updated in April 2018. The desk study focused on obtaining records of the following types of protected or notable designated sites and habitats:

a) United National Education, Scientific and Cultural Organisation (UNESCO) Biosphere Reserves;

b) Special Areas of Conservation (SACs) and candidate SACs;

c) Specially Protected Areas (SPAs) and proposed SPAs;

d) Ramsar sites;

e) biological Sites of Special Scientific Interest (SSSIs) including proposed SSSIs;

f) National Nature Reserves (NNRs);

g) Local Nature Reserves (LNRs);

h) Local Wildlife Sites (LWSs);

i) Ancient Woodland Inventory sites;

j) Habitats of Principal Importance (HPI) in England included on Section 41 of the Natural Environment and Rural Communities Act 2006;

k) important hedgerows as defined by The Hedgerows Regulations 1997; and

l) habitats on the Wiltshire Biodiversity Action Plan (BAP).

8.5.7 Relevant information was sought on species included on any of the following statutes or lists:

a) Annex 1, Annex 2 and Annex 4 of the Habitats Directive (Council Directive 92/43/EEC);

b) Annex 1 of the Birds Directive (Council Directive 2009/147/EC);

c) Schedules 1, 5, 8 or 9 of the Wildlife and Countryside Act, 1981;

d) Species of Principal Importance (SPI) in England included on Section 41 of the Natural Environment and Rural Communities Act 2006;

e) Birds of Conservation Concern (red list or amber list);

f) Joint Nature Conservation Committee Conservation designations for UK taxa spreadsheet containing details of species listed on the UK or England

Red Data Book and National Notable, Nationally Rare or Nationally Scarce species;

g) species with a specific plan on the Wiltshire Biodiversity Action Plan (BAP).

8.5.8 The following desk study sources were used, contacted and/or reviewed. Records of protected and notable species were considered relevant if from the period 2008 to 2018. Records older than this were reviewed but not included in the assessment. Survey data from an earlier scheme proposal from 2002 were also reviewed, because the coverage was detailed and similar to the location for the Scheme. Data sources included:

a) Ordnance Survey mapping;

b) a data search provided by WSBRC 2017;

c) the Government's MAGIC website;

d) Natural England's Ancient Woodland Inventory and Priority Habitat maps;

e) the Woodland Trust's Ancient Tree Hunt map for the UK;

f) publicly available aerial imagery and aerial photography data obtained for the Scheme;

g) Environment Agency aquatic macroinvertebrate monitoring data (Rivers Avon and Till);

h) wintering bird records from the Wiltshire Bird Atlas;

i) stone curlew breeding records from RSPB (2002-2017);

j) stone curlew plot locations from RSPB (2017);

k) barn owl nest and mortality records from the local barn owl recorder.

Field study method

8.5.9 In order to address gaps in baseline data within the study area, habitat and species surveys listed in Table 8.7 were undertaken. The scope of these surveys was determined through the desk study and by consultation with stakeholders, including Natural England and the RSPB, as described in the EIA Scoping Report (Ref 8.6).

8.5.10 Some of the baseline surveys were started prior to the selection of the preferred route in 2017 and covered both the northern and southern options for the bypass of Winterbourne Stoke. Where necessary, the survey coverage was updated in 2017 or 2018 during development of the Scheme. Table 8.7 gives an outline of the areas surveyed for the biodiversity features.

Table 8.7: Summary of the study area for the likely important biodiversity features

Biodiversity survey	Study area
Lichen	Lichen surveys were undertaken in 2016 and 2017 within areas considered potentially important for lichen communities. These included the Stonehenge stones, Parsonage Down SSSI/SAC and Salisbury Plain SAC near the A303 and Bulford camp (Figure 8.6).
Phase 1 habitat	In 2017 a survey of all habitats within 125m of the centreline of the 2016 route options was undertaken. The survey has been updated in 2018 to include all habitats within 200m of the Scheme boundary. This included a search for invasive/ non-native species (Figure 8.5).
National Vegetation Classification (NVC)/ scarce arable flora	NVC surveys were undertaken in habitats that were deemed notable or important within 200m of the 2016 Scheme options, based on the desk study and habitat survey. 27 suitable arable field margins within 200m of the 2016 Scheme options were surveyed (Figure 8.6).
Important hedgerow	In 2017 a survey of all species-rich hedgerows (identified within the Phase 1 Habitat survey) within 125m of the centreline of the 2016 route options was undertaken. The survey has been updated in 2018 to include all species-rich hedgerows within 200m of the Scheme boundary.
River Habitat Survey (RHS)	Surveys were undertaken within 2017 along six 500m reaches within the River Avon and River Till. The River Avon surveys extended approximately 1km upstream and 2km downstream from the current A303 crossing. The River Till surveys extended approximately 0.5km upstream and 2.5km downstream of the proposed River Till crossing.
Aquatic macrophyte	Surveys were carried out in the same 500m reaches as the RHS.
Desmoulin's whorl snail (*Vertigo moulinsiana*)	Surveys were undertaken within 2016 along a 3km stretch of the River Till and 1.5km upstream and 6km downstream of Amesbury on the River Avon. The survey focussed on areas of suitable habitat on river margins and associated floodplains.
Aquatic macroinvertebrate	Surveys were carried out within 2016 and 2017 in the same study area as the RHS, and in two springs (Blick Mead and West Amesbury) near Amesbury.
White clawed crayfish (*Austropotamobius pallipes*)	Surveys within 2017 were carried out on the approximately 800m stretch of the River Avon (including a small number of side channels) associated with the existing A303 road bridge near Amesbury, and approximately a 450m stretch of the River Till near Berwick St James.
Terrestrial invertebrate	Eight sites were surveyed, these sites were selected from areas predicted to have important habitats for invertebrates within or adjacent to the 2016 Scheme options. These sites included two sites on the River Till, Parsonage Down (which also included a focused survey for marsh fritillary), Diamond wood, three of the most botanically diverse arable field margins and Countess Cutting (Figure 8.7).
Fish	Surveys were carried out within the same study area as the RHS.

Biodiversity survey	Study area
Great Crested Newt (GCN) (*Triturus cristatus*)	All water bodies were assessed within 500m from the 2016 and 2017 route options. Further surveys were undertaken within 2018 to ensure all water bodies within 500m of the Scheme were assessed (Figure 8.8).
Reptile	The study area focused on the existing A303 (verges and cuttings), the proposed River Till crossing point and the bases of arable hedgerows. This study area can be used to extrapolate the likely presence of reptiles within the Scheme boundary as a whole. A habitat assessment update was undertaken in 2018 of all areas within 100m of the Scheme boundary (Figure 8.9).
Breeding bird	The study area provided coverage of the 2016 route options. In total seven transect routes were walked. Transects routes were designed to give suitable coverage of the habitats considered to be of value to breeding birds within the study area (Appendix 8.15).
Wintering bird	Following consultation with Natural England Discretionary Advice Service (DAS), wintering bird surveys were not considered necessary. Records for wintering birds were obtained from the Wiltshire Ornithological Society for twenty tetrads (2x2km^2) near to the Scheme.
Quail (*Coturnix coturnix*)	The study area covered the 2016 route options. Three transect routes were identified for their suitability to support quail (Appendix 8.15).
Barn owl (*Tyto alba*)	It was not considered necessary to undertake specific barn owl surveys as comprehensive information on breeding locations and road mortalities within 1.5km of the 2016 route options was provided by Nigel Lewis of the Hawk and Owl Trust (Figure 8.11). Habitats within 1.5km of the Scheme boundary were assessed on the suitability to offer potential foraging and commuting barn owl habitat. This was undertaken using a combination of aerial imagery and field surveys undertaken as part of the 2018 update field surveys (Figure 8.10).
Stone curlew (*Burhinus oedicnemus*)	Detailed monitoring of stone curlew breeding within the study area is undertaken annually by the RSPB. To avoid duplication of effort and potential disturbance, RSPB supplied data from annual monitoring in 2017 and previous years. Information on breeding locations within 5km of the consulted route options was provided by the RSPB (Figure 8.11).
Badger (*Meles meles*)	All accessible habitats within 125m of the 2016 route options were surveyed for badgers. The survey was updated in 2018 to include all areas previously not surveyed within 100m of the Scheme boundary (Figure 8.12).

Biodiversity survey	Study area
Bat	All trees and structures within 100m of the 2016 route options (excluding the area where the Scheme is in tunnel) were assessed for their suitability for roosting bats. Surveys included emergence and re-entry surveys where appropriate. Bat activity surveys consisting of walked transects and automated static detector surveys were undertaken for the 2016 route options (Figure 8.14 and 8.15). Bat crossing point surveys were undertaken for certain linear features that were to be directly bisected by the 2016 route options. Further crossing point surveys undertaken within 2018, will update the baseline (Figure 8.14). Bat trapping and radio-tracking surveys were undertaken within 2km of the current A303. The radio-tracking surveys extended up to 6km from the current A303.
Hazel dormouse (*Muscardinus avellanarius*)	The surveys were undertaken in suitable habitat within 125m of the 2016 Scheme options. This study area covers all habitats with suitability for hazel dormouse within the Scheme boundary and is considered suitable to identify the presence of dormouse.
Water vole (*Arvicola amphibius*)	Surveys were undertaken on all waterbodies, aside from waterbodies that were deemed too small or isolated, within 500m of the 2016 Scheme options. This included the River Avon and the River Till and their tributaries This extent is deemed sufficient to assess the likely impacts on water vole (Figure 8.16).
Otter (*Lutra lutra*)	Surveys were undertaken on all waterbodies, aside from waterbodies that were deemed too small or isolated, within 500m of the 2016 Scheme options. This included the River Avon and the River Till and their tributaries This extent is deemed sufficient to assess the likely impacts on otter (Figure 8.17).

8.5.11 The survey methods are summarised within Table 8.8 and additional details are provided in the baseline reports in Appendix 8.2A-8.23.

Table 8.8: Field study methods

Biodiversity Survey	Field study methods	Dates of survey	Reference/ Appendix
Lichen	The survey followed good practice methods (Ref 8.8).	September 2017	Appendix 8.2A, 8.2B and 8.2C
Phase 1 habitat	The Phase 1 habitat survey followed the standard JNCC methodology (Ref 8.9).	Various months 2017 and 2018	Appendix 8.3A and 8.3B
National Vegetation Classification (NVC)	Standard NVC sampling (Ref 8.10) was employed for all vegetation types surveyed using this method. None of the wooded habitats were sufficiently large enough to be sampled by standard means and for these the minimalistic NVC woodland sampling approach was used (Ref 8.11).	June and August 2017	Appendix 8.4

Biodiversity Survey	Field study methods	Dates of survey	Reference/ Appendix
Scarce arable flora	Arable field margins were surveyed following methodology developed by Plantlife for determining sites of importance for arable plant (Ref 8.12)	July 2017	Appendix 8.4
Hedgerow survey	The hedgerow survey followed the guidelines in the Hedgerow Survey Handbook (Ref 8.13)	August-September 2017 and April 2018	Appendix 8.5
River Habitat Survey (RHS)	Field surveys were undertaken following published standards for River Habitat Surveys (Ref 8.14).	August 2016 and May 2017	Appendix 8.6A and 8.6B
Aquatic macrophyte	Two survey methods were applied: (i) the Holmes method for surveying macrophytes and determining river community type, as described in Life in UK Rivers (Ref 8.15), applied at a 500m reach scale; and (ii) the LEAFPACS method as described in the UK TAG guidance for Water Framework Directive monitoring (Ref 8.16), applied at a 100m reach scale.	August 2016 and May 2017	Appendix 8.7
Desmoulin's whorl snail	Survey broadly followed the 'level 1' survey techniques detailed in Killeen and Moorkens (2003) (Ref 8.17) targeting areas of suitable habitat along the River Avon and River Till.	October and December 2016	Appendix 8.8
Aquatic invertebrate	A standardised sample was collected at each site in accordance with RIVPACS (Ref 8.18) sampling protocols. A number of biotic indices were calculated from the macroinvertebrate data collected to provide information on the macroinvertebrate communities': sensitivity to organic pollution, changes in flow, habitat modification and siltation.	October 2016 and May 2017	Appendix 8.9
White clawed crayfish	A combination of survey techniques were used to survey both the River Till and River Avon. These were artificial refuge traps, funnel traps, hand-searching, and torch surveys. All surveys were undertaken following standard best practice (Ref 8.19).	August-October 2017	Appendix 8.10
Terrestrial invertebrate	At each sample site, a range of invertebrate sampling techniques was used. In general, the sampling strategy used at each site has followed the habitat-specific invertebrate sampling protocols advocated by Natural England for assessing the impact of development on terrestrial and freshwater invertebrate assemblages (Ref 8.20). Primarily this involved the follow hand searching techniques: beating, ground searching, pond netting and sieving, sweeping, spot-searching and tapping.	June and July 2017	Appendix 8.11

Biodiversity Survey	Field study methods	Dates of survey	Reference/ Appendix
Fish	Fish surveys were undertaken using a combination of methods depending on the depth, profile and width of the water course. All electric fishing surveys followed standard practice for operators and equipment (Ref 8.21 and 8.22). Lamprey ammocoete (larvae) surveys followed the LIFE method (Ref 8.23), which uses electric fishing within a standard 1m square quadrat.	October 2016 and May 2017	Appendix 8.12
Great Crested Newt (GCN)	A combination of eDNA surveys and Habitat Suitability Index (HSI)was used in order to scope the requirement for further GCN surveys, and these were undertaken in accordance with standard best practice (Ref 8.24 and 8.25). An absence/ presence survey using other field techniques was carried out on all water bodies that were assessed as 'below average' or above by the HSI survey or where the eDNA survey results were negative. All surveys were undertaken in accordance with standard best practice (Ref 8.26).	2016, 2017 (HSI and eDNA); April-June 2017 (survey)	Appendix 8.13
Reptiles	An assessment of reptile habitat suitability was undertaken for habitats within 200m of the Scheme boundaries. Following the Natural England Discretionary Advice Service (DAS) advice it was not considered necessary to undertake further reptile surveys as reptile populations were unlikely to have changed from that assessed in 2002.	May 2018 (habitat appraisal)	Appendix 8.14
Breeding bird and quail	The breeding bird surveys broadly followed the Common Birds Census (CBC) methodology (Ref 8.27). Three surveys visits were undertaken at the quail survey transects in line with standard survey guidance (Ref 8.27).	May-July 2016 (quail); April-July 2017 (breeding birds)	Appendix 8.15 (Confidential)
Wintering birds	Following the Natural England DAS advice it was not considered necessary to undertake wintering bird surveys. Data was obtained from the Wiltshire Ornithological Society's bird atlas for 'winter abundance 2007-2012'.	Atlas data	Appendix 8.1A
Barn owl	Following consultation with the RSPB and the Natural England DAS (Ref 8.28), it was not considered necessary to undertake specific barn owl surveys as comprehensive information on breeding locations and road mortalities within 1km of the 2016 route options was provided. A desk-based exercise was used whereby barn owl foraging habitat was mapped (Ref 8.65)	May 2018 (habitat appraisal)	Figure 8.10 and Figure 8.11

Biodiversity Survey	Field study methods	Dates of survey	Reference/ Appendix
Stone curlew	Following consultation with the RSPB and the Natural England DAS (Ref 8.28), it was not considered necessary to undertake any specific field surveys for stone curlew.	RSPB annual monitoring data	Figure 8.11
Badger	The survey was completed with regard to good practice guidelines (Ref 8.29). The results of which were updated within February to May to include area previously not surveyed within 200m of the Scheme boundary.	Various 2016, 2017 and 2018	Appendix 8.16 (Confidential)
Bats	The following surveys were undertaken: preliminary bat roost assessment of buildings and trees, bat activity transect surveys, bat activity automated static detector surveys, aerial tree climbing surveys, emergence/ re-entry surveys of buildings and trees, crossing point surveys and bat trapping and radio-tracking surveys. The surveys were undertaken with consideration of current best practice (Ref 8.30, 8.31, 8.32, 8.33, 8.34 and 8.35).	June 2016-August 2017	Appendix, 8.17, 8.18, 8.19 (Confidential) , 8.20 (Confidential)
Hazel dormouse	Artificial nest tubes (340) and nest boxes (20) were deployed in suitable habitat and checked a minimum of four occasions to record the presence of small mammals. The survey was completed in line with good practice guidelines (Ref 8.36)	August 2016 –November 2017	Appendix 8.21
Water vole	Survey followed published guidance for water vole survey (Ref 8.37) bank and boat based surveys were undertaken. The bank based survey was carried out on foot searching for water vole field signs and suitable habitat.	2017	Appendix 8.22 (Confidential)
Otter	Survey followed published guidance for otter survey (Ref 8.38) bank and boat based surveys were undertaken. The bank based survey was carried out on foot searching for otter field signs and potential resting sites.	2017	Appendix 8.23 (Confidential)
Other SPIs	Incidental sightings of SPIs were recorded although no specific surveys were undertaken.	Not Applicable	Not Applicable

Limitations

8.5.12 As the study area incorporated all the previous route options, the area covered was greater than was necessary for the Scheme. The study area was extended in 2017/ 2018 to cover changes in the Scheme boundary. Update surveys included a walkover of all additional areas (where necessary) to identify any further biodiversity constraints. The update surveys were considered sufficient to inform the current ES.

8.5.13 Specific limitations relevant to the survey types, such as access constraints are detailed within the technical reports (Appendices 8.2 – 8.23). It is not considered that any of these survey specific constraints constitute a significant limitation to identifying and assessing the value of the biodiversity receptors.

8.5.14 As described in Chapter 2 (The Scheme, Section 2.4), discussions have been ongoing with the water and power utilities providers regarding the requisite connections for the Scheme. In the assessment it is assumed that the connection provided by the water utilities provider at the eastern end of the Scheme would avoid the Countess Swamp County Wildlife Site.

8.6 Baseline conditions

8.6.1 The following section sets out baseline information on statutory and non-statutory designated sites, habitats and species used to inform the assessment of ecological impacts on biodiversity features.

8.6.2 The findings of the desk study and field surveys are discussed alongside each other for each designated site, habitat type and species/ species group/ species assemblage. The results of the desk study are summarised within Appendix 8.1A and detailed survey reports included within Appendices 8.2A-8.23.

Statutory designated sites

8.6.3 Statutory designated sites within the study area are shown in Table 8.9.

8.6.4 Baseline information on designated sites presented in this section is based on data provided by the JNCC, Natural England or Local Biodiversity Records Centre. Valuations of designated sites are based on interpretation of this baseline information.

8.6.5 There are three statutory designated sites of **International Importance/ Very High Value** within 2km of the Scheme boundary (Figure 8.1). There are seven statutory designated sites of **National Importance/ High Value** within 2km of the Scheme boundary (Figure 8.2), four of which are wholly or partially contained within a site of International importance.

8.6.6 Three SACs bats were identified within 30km of the centre line of the Scheme. The closest of which is Chilmark Quarries, located approximately 10km southwest of the Scheme. This SAC is a complex of abandoned mines. It is regularly used by small numbers of Barbastelle bat (*Barbastella barbastellus*) and is a hibernation site for greater horseshoe bats (*Rhinolophus ferrumequinum*). The site also contains an important assemblage of other bat species, including Bechstein's bat (*Myotis bechsteinii*). The second site is Mottisfont Bats SAC, a woodland site approximately 17km southeast of the Scheme, which supports an important population of Barbastelle. It is one of only six known maternity sites in the UK (2002 data) and the only one in Hampshire. The third site is Mells Valley SAC, a complex of scrubland and caves, located approximately 29.6km northwest of the Scheme. The site contains an exceptional breeding population of greater horseshoe bats. It contains a

maternity site associated with a population comprising about 12% of the UK greater horseshoe population.

Table 8.9: Statutory designated sites of nature conservation value within the study area

Designated Sites	Location in relation to the Scheme	Summary of reason for designation
Statutory designated sites of International Importance/ Very High Value		
River Avon SAC	Crossed by the Scheme in four locations at the River Till viaduct, A345 River Avon crossing, A303 River Avon crossing and River Avon crossing north of Countess services.	Annex I Habitats (primary reason): The presence of "*water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation"*. Annex II Species (primary reason): The Avon is also designated for a range of aquatic fauna including Desmoulin`s whorl snail, sea lamprey (*Petromyzon marinus*), brook lamprey (*Lampetra planeri*), Atlantic salmon (*Salmo salar*) and bullhead (*Cottus gobio*).
Salisbury Plain SPA	Located adjacent to the Scheme boundary in two locations at Bulford camp in the eastern part of the Scheme and Rollestone cross to the north of the Scheme.	The largest remaining area of chalk grassland in North West Europe, Salisbury Plain is located in central southern England as a plateau of Upper and Middle Chalk to the north of Salisbury. The SPA supports approximately 22 breeding pairs of stone curlew (approximately 11% of the breeding population within Great Britain) during the summer and approximately 2 % of the wintering population of hen harrier (*Circus cyaneus*). The SPA also qualifies under Article 4.2 of the Birds Directive for supporting nationally important breeding populations of two regularly occurring migratory species. It supports approximately 20% of the British population of quail (*Corturnix coturnix*) and 1% of the British population of hobby (*Falco subbuteo*).
Salisbury Plain SAC	Located adjacent to the Scheme boundary in three locations at Bulford camp in the eastern part of the Scheme, Parsonage Down near the western end of the Scheme and Rollestone cross to the north of the Scheme.	Annex I Habitats (primary reason): The presence of "*Juniperus communis* formations on heaths or calcareous grasslands" and "Semi-natural dry grasslands and scrubland facies on calcareous substrates (*Festuco-Brometalia*)" The juniper within Salisbury Plain is juxtaposed with semi-natural dry grassland and chalk heath. It is believed to be the largest surviving semi-natural dry grassland within the EU and is therefore the most important site for this habitat in the UK. Annex II Species (primary reason): The Salisbury Plain is designated for the marsh fritillary butterfly (*Eurodryas aurinia*), which occurs on chalk grassland.

Designated Sites	Location in relation to the Scheme	Summary of reason for designation
Statutory designated sites of National importance/ High Value		
Salisbury Plain SSSI	Located adjacent to the Scheme boundary in two locations near Bulford camp to the far east of the Scheme and Rollestone cross to the north of the Scheme.	The SSSI supports assemblages of nationally scarce, rare red data book (RDB) species of invertebrates, including moths, downland butterflies, bees, true flies, and crustaceans. The area as a whole is important for breeding and wintering birds (being part of the Salisbury Plains SPA). It supports seven species listed on Annex 1 of the EC Directive on the Conservation of Wild Birds, populations of six species of red data bird and several species of candidate red data birds. The SSSI supports important breeding assemblages of stone curlew, quail, and hobby, other species include buzzard (*Buteo buteo*), barn owl, long-eared owl (*Asio flammeus*), nightingale (*Erithacus megarhynchos*), stonechat (*Saxicola rubicola*), whinchat (*Saxicola rubetra*), wheatear (*Oenanthe oenanthe),* corn bunting (*Emberiza calandra*) and on occasion, Montagu's harrier (*Circus pygargus*).
River Avon System SSSI	Crossed by the Scheme	A rich and varied chalk stream of national and international importance for its wildlife communities (as River Avon SAC above). The River Avon system also supports breeding populations of kingfisher (*Alcedo atthis*), reed warbler (*Acrocephalus scirpaceus*). The system is well used by water voles and water shrews (*Neomys fodiens*), with occasional recent evidence of otter. The system also supports a variety of invertebrate and contains most of the species associated with a large river running through calcareous areas. It is also important as a feeding site for passage birds, in particular common sandpiper (*Tringa hypoleucos*), green sandpiper (*Tringa ochropus*) and garganey (*Anas querquedula*).
River Till SSSI	Crossed by the Scheme	A winterbourne chalk stream containing internationally important *Ranunculion fluitantis* and *Callitricho-Batrachion*, with an associated area of reed canary grass swamp, and supporting important fish species bullhead and salmon, and Desmoulin's whorl snail (within River Avon SAC). The upper part of the River Till SSSI is a Winterbourne, supported by water flowing from the aquifer in winter and early spring. As aquifer levels fall to a more stable level in summer, the river flows from a perennial head in the mid-section of the Till.
Parsonage Down SSSI	The SSSI is located adjacent to the Scheme.	An area of important chalk downland with species-rich lowland calcareous grassland (within Salisbury Plain SAC/SPA). The botanically-rich grassland which covers most of the site is broadly referable to the sheep's-fescue -- meadow oat-grass *Festuca ovina -- Avenula pratensis* type. Red fescue (*Festuca rubra*) and downy oat-grass (*Avenula pubescens* also occur in areas of herb-rich turf. This unusual feature may be related to local soils and topography.

Designated Sites	Location in relation to the Scheme	Summary of reason for designation
Parsonage Down NNR	The NNR is partially located within Scheme boundary.	Parsonage Down is a managed working farm owned by Natural England. Most of the NNR (Parsonage Down SSSI) supports extensive areas of lowland calcareous grassland and is known to support over 150 species of wildflowers (SSSI).
Yarnbury Castle SSSI	Located approximately 80m from the Scheme boundary.	The site supports a rich lowland calcareous grassland flora which includes several plants of nationally restricted distribution. Marsh fritillary and small heath butterflies have been recorded.
Steeple Langford Down SSSI	Located approximately 840m from the proposed boundary.	An area of exceptionally herb-rich chalk grassland supporting several plant species that have a restricted distribution in Britain.

Non-statutory designated sites

8.6.7 There are eight non-statutory designated sites within 500m of the Scheme boundary (Figure 8.3). Table 8.10 provides summary information for these sites, including their location in relation to the Scheme and reasons for their designation. These non-statutory sites have been designated by the local planning authority and protected through local planning policies as they support important habitats and/or species of nature conservation value within the county. As such, all of the non-statutory designated sites within the study area are considered to be of **County Importance/ Medium Value** with the exception of Parsonage Down CWS, which when visited did not reach the CWS criteria; as such, Parsonage Down CWS is considered to be of **Site Importance/ Less than Low Value.**

Table 8.10: Non-statutory designated sites within the study area

Designated Sites	Location in relation to the Scheme	Summary of reason for designation
Countess Cutting CWS	Located entirely within the Scheme boundary	Early-succession chalk grassland on a steep south-facing road cutting.
Parsonage Down CWS	Partly located within the Scheme boundary	Part of the NNR which is outside (but immediately adjacent to) the SSSI boundary. This land at Cherry Lodge consists of arable and improved grass leys, which support the farming that maintains the adjacent SSSI.
Luxenborough Banks CWS	Partly located within the Scheme boundary	Two small areas of remnant chalk grassland surrounded by arable and arable reversion.
Countess Farm Swamp CWS	Partly located within the Scheme boundary	An area of derelict water meadow adjacent to the Salisbury Avon, with tall-herb, rank grassland, reed bed, poor fen and willow scrub.
Stonehenge Down CWS	Located adjacent to the Scheme boundary	An area of level calcareous grassland.
Normanton Down RSPB Reserve	Located approximately 50m from the Scheme boundary	Former arable conversion to chalk grassland being managed to encourage breeding stone curlews and other birds such as lapwing and corn bunting.

Designated Sites	Location in relation to the Scheme	Summary of reason for designation
Vinies Farm Meadow CWS	Located approximately 490m from the Scheme boundary	A small wet meadow by the River Avon.
Cow Down CWS	Located approximately 490m from the Scheme boundary	A forked coombe with unimproved calcareous grassland.

Habitats

8.6.8 Six HPIs were identified within the 500m study area during the desk study: coastal and floodplain grazing marsh, deciduous woodland, good quality semi-improved grassland, lowland calcareous grassland, lowland fens, and lowland meadows. Of which, only good quality semi-improved grassland, lowland calcareous grassland, deciduous woodland and lowland fens occur within the Scheme boundary and are illustrated in Figure 8.4.

8.6.9 The description of the habitats present is based on the Phase 1 habitat survey of 2017 and the 2018 update survey (Appendix 8.3A and B), supplemented by the important hedgerow surveys (Appendix 8.5), arable flora surveys and further detailed botanical surveys (Appendix 8.4), aquatic macrophyte survey (Appendix 8.7A and B) and RHS (Appendix 8.6). The main habitats associated with the Scheme are summarised below and illustrated in Figure 8.5.

8.6.10 A total of 28 habitat types were recorded in the Phase 1 habitat survey across the 2016, 2017 and 2018 study area. Arable fields were predominant in terms of area, followed by improved grassland and chalk grassland from arable reversion, plus some broadleaved and mixed plantation woodland. The most extensive area of unimproved grassland is the calcareous grassland of Parsonage Down SSSI.

8.6.11 Table 8.11 provides a condensed summary of the habitats present within the study area and an overview of the evaluation. More detail on the evaluation of importance is given in Appendix 8.1B. Full descriptions of the baseline conditions are given in other Appendices and accompanying Figures, as indicated in the table.

Table 8.11: Summary evaluation of habitats present within the Scheme and study area

Habitat	Summary description and rationale for evaluation	Location in relation to the Scheme	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Semi-natural woodland	No ancient woodland was identified during the desk study. Woodland habitats are listed as an HPI, however, only small discrete areas of willow (*Salix* sp.) dominated wet woodland is located adjacent to River Till and River Avon, and none of the semi-natural woodland within the study area meets the criteria for county importance (Ref 8.39).	Adjacent to Scheme at River Avon	Local	Low	Appendix 8.1B, 8.3A, 8.3B and 8.4.	Figure 8.5
Plantation woodland	Woodland habitats are listed as an HPI, however, only small and fragmented blocks of plantation woodland are located within the study area. These are generally managed as game cover crop and mainly support beech (*Fagus sylvatica*), ash (*Fraxinus excelsior*), larch (*Larix decidua*) and pine (*Pinus* sp.) with understories of hawthorn (*Crataegus monogyna*), elder (*Sambucus nigra*), holly (*Ilex aquifolium*), Wilson's honey suckle (*Lonicera nitida*) and laurel (*Laurus* sp.).	Within study area, and area adjacent west of Winterbourne Stoke	Site	Less than Low	Appendix 8.1B, 8.3A, 8.3B and 8.4	Figure 8.5
Scrub	Small areas of generally isolated hawthorn, blackthorn (*Prunus spinosa*) and bramble (*Rubus fruticosus* agg.) scrub is present, mainly on the soft estate.	Some scrub within Scheme and study area	Site	Less than Low	Appendix 8.1B, 8.3A and B	Figure 8.5
	Juniper (*Juniperus communis*) scrub is present on a large highway cutting located to the far east of the Scheme within the Salisbury Plain SAC (assessed within the SAC section paragraph 8.9.20 – 24 and 8.9.181 - 185).	Adjacent to Scheme	County	Medium	Appendix 8.1B, 8.3A and 8.3B	Figure 8.5
Scattered trees	Various scattered trees are located within the study area, mainly on field boundaries or in soft estate.	Within Scheme and study area	Site	Less than Low	Appendix 8.1B, 8.3A and 8.3B	Figure 8.5
	A single veteran beech tree is located to the north of New Kings Barrow and other mature trees with high or moderate bat roost potential.	Within study area	Local	Low	Appendix 8.1B	Not Applicable

Habitat	Summary description and rationale for evaluation	Location in relation to the Scheme	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Calcareous unimproved grassland	Lowland calcareous grassland habitats are listed as an HPI. The study area supports extensive areas of calcareous unimproved grassland are present within Parsonage Down SSSI/SAC.	Within study area and within Scheme.	National	High	Appendix 8.1B, 8.3A, 8.3B and 8.4	Figure 8.5
	Small areas and fragments of calcareous grassland are also located at Countess Cutting CWS sites and along tracks on farmland. These habitats are considered to be particularly important for terrestrial invertebrate species.	Within study area and within Scheme.	County	Medium	Appendix 8.1B, 8.3A, 8.3B and 8.4	Figure 8.5
	Small fragmentations of calcareous grassland along tracks and farmland	Within study area	Local	Low	Appendix 8.1B, 8.3A, 8.3B and 8.4	Figure 8.5
Semi-improved grassland	Neutral and calcareous semi-improved grassland is mainly located on arable reversion grassland within the study area. This grassland has been created through seeding and shows characteristics of both neutral and calcareous grassland, dependent on the stage of its transition between a neutral to a calcareous grassland. Semi-improved grassland is also present on arable headlands, grazed grassland and road-side verges, this has limited biodiversity value.	Within Scheme and study area	Site	Less than Low	Appendix 8.1B, 8.3A, 8.3B and 8.4	Figure 8.5
	Good quality semi-improved grassland and lowland calcareous grassland are listed as HPIs. Semi-improved grassland with more calcareous grassland characteristics is of greater conservation value.	Within Scheme and study area	Local	Low	Appendix 8.1B, 8.3A, 8.3B and 8.4	Figure 8.5
Improved grassland	Agriculturally productive grassland is mainly located adjacent to Parsonage Down to the east of the River Till valley. The habitat has limited biodiversity value.	Within Scheme and study area	Site	Less than Low	Appendix 8.1B, 8.3A and 8.3B	Figure 8.5

Habitat	Summary description and rationale for evaluation	Location in relation to the Scheme	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Marginal inundation vegetation	Floodplain grazing marsh habitats are listed as an HPI, however only very limited areas of emergent vegetation are located adjacent to the River Avon and within Countess Swamp CWS. Mainly dominated by branched bur-reed (*Sparganium erectum*). It is also present within the channel of the winterbourne River Till during its dry period.	Adjacent to Scheme and study area	Local	Low	Appendix 8.1B, 8.3A, 8.3B and 8.4	Figure 8.5
Running water	Rivers are listed as an HPI. Both rivers located within the study area are located within the River Avon SAC and support habitats that are one of the designating reasons of the SAC. The River Avon supports *Ranunculion fluitantis and Callitricho – Batrachion* vegetation, with stream water-crowfoot (*Ranunculus penicillatus ssp. pseudofluitans*), water starwort (*Callitriche* spp.), common watercress (*Rorippa nasturtium-aquaticum*) and wild parsnip (*Berula erecta*). The River Till supports a similar community where it has year-round water. Although, pond water-crowfoot (*Ranunculus peltatus*) and fool's watercress (*Apium nodiflorum*) is more abundant in the winterbourne section, which dries out in summer.	Within/ crossed by Scheme and study area	County	Medium	Appendix 8.1B, 8.3A, 8.3B, 8.4 and 8.6B	Figure 8.5
Arable	Arable fields form the majority of habitat within the study area, and are mainly intensively managed with low diversity of annual species.	Within Scheme and study area	Site	Less than Low	Appendix 8.1B, 8.3A, 8.3B, and 8.4.	Figure 8.5 and Figure 8.6
Arable field margins	Arable field margin habitats are listed as an HPI. The assemblages of arable flora recorded within individual fields did not exceed the threshold score of 30 or more for County Importance on calcareous soils (Ref 8.12), but since that publication arable flora has continued to decline and as chalk soils have proportionally more of the regional and national resource a lower threshold is potentially applicable.	Within Scheme and study area	Site - County	Less than Low-Medium	Appendix 8.1B, 8.3A, 8.3B and 8.4.	Figure 8.5 and Figure 8.6

Habitat	Summary description and rationale for evaluation	Location in relation to the Scheme	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Amenity grassland	Small areas of amenity grassland are present adjacent to buildings/ urban areas, these areas have limited biodiversity value.	Within study area	Site	Less than Low	Appendix 8.1B, 8.3A and 8.3B	Figure 8.5
Hedgerows	Hedgerows are listed as an HPI. Relatively few hedgerows are located within the Scheme and study area. These tend to be species poor, fragmented or isolated from suitable surrounding habitat. The majority of hedgerows are located near Winterbourne Stoke and the River Till valley, also east of River Avon.	Within Scheme and study area	Site	Less than Low	Appendix 8.1B, 8.3A, 8.3B and 8.5	Figure 8.5 and Figure 8.6
	Two hedgerows have been classed as Important Hedgerows under the Hedgerow Regulations.	Within study area	County	Medium	Appendix 8.1B, 8.3A, 8.3B and 8.5	Figure 8.5 and Figure 8.6

Species and species assemblages

8.6.12 A condensed summary of the species and species assemblages present within the study area is presented in Table 8.12 and an overview of the evaluation. Further detail on the evaluation is provided in Appendices 8.1A and B. Full descriptions of the baseline conditions are given in other Appendices and accompanying Figures, as indicated in Table 8.12.

Table 8.12: Summary evaluation of species and species assemblages

Biodiversity Feature	Summary description and rational	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Lichen	Stonehenge stones have a unique flora due to the stones of different geology brought to site. The lichen communities associated with Stonehenge include many maritime species such as *Ramalina siliquosa*, which are rare or absent inland. The species assemblage is considered to be unique within the UK; as such, it has been assessed as having high value.	National	High	Appendix 8.1A, 8.1B and 8.2A	Figure 8.6
	The only category of lichens that would be relevant to the conservation status of the primary interest feature (calcareous grassland) of the SAC is terricolous lichens (those that grow on the ground). Only two terricolous lichens were recorded at Beacon Hill and neither of these are notable. The notable lichens at Beacon Hill are all corticolous (species which grow on bark) except for *Verrucaria ochrostoma* which is present on concrete.	Site	Less than Low	Appendix 8.1A, 8.1B and 8.2B	Figure 8.6
	Limited assemblage of nitrogen-tolerant lichens at Parsonage Down, not in calcareous grassland. A single nationally rare species was recorded during the surveys; however, it is likely to be under recorded rather than rare (Ref 8.40).	Site	Less than Low	Appendix 8.1A, 8.1B and 8.2C	Figure 8.6
Aquatic macro-invertebrates	The River Till supports a rich variety of macro-invertebrate species that are typical of high water quality. The mayfly *Paraleptophlebia werneri*, was recorded within the study area, it is listed as Rare in the RDB and is categorised as nationally scarce (Ref 8.41). This species is considered to be an ephemeral specialist; however, it has not been included in the River Till SSSI designation.	County	Moderate	Appendix 8.1A, 8.1B and 8.7B	Figure 8.7
	The River Avon contained an assemblage of macro-invertebrates considered to have moderate species richness more diverse than that of the River Till, however no protected or RDB species occurred within the study area. Two notable species were recorded; these were the regionally notable shrimp species, *Niphargus aquilex* and notable riffle beetle species, *Riolus subviolaceus.*	County	Moderate	Appendix 8.1A, 8.1B and 8.7A	Figure 8.7
	Two springs (Blick Mead spring and West Amesbury spring) that feed directly into the River Avon were also surveyed. The species diversity of the two springs that feed into the River Avon is considered to be low, and were typical of a low flow environment with a lot of leaf litter. Species included leeches, flatworms, mussels, and limpets, with no RDB species being recorded.	Site	Less than Low	Appendix 8.1A, 8.1B and 8.7A	Figure 8.7

Biodiversity Feature	Summary description and rational	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Desmoulins' whorl snail	Five populations of Desmoulin's whorl snail were recorded by the River Avon, downstream of the existing A303 (between West Amesbury and Normanton). These populations are one of the reasons for the selection of the River Avon SAC. All populations were identified in habitats dominated by greater pond sedge (*Carex riparia*) with high water table. Desmoulin's whorl snail was not recorded in River Till/ Till valley. It is considered to be absent from the study area in the River Till catchment.	National	High	Appendix 8.1A, 8.1B and 8.8	Figure 8.7
Fish	The River Avon section supports a chalk river community. A total of 12 species were recorded, including Annex II fish species that are a primary reason for the selection of the River Avon SAC, such as bullhead (*Cottus gobio*), and brook lamprey (*Lampetra planeri*). Other species include brown trout European eel (*Anguilla anguilla*) was at varying densities throughout.	National	High	Appendix 8.1A, 8.1B and 8.12A	Figure 8.7
	The River Till winterbourne section has a characteristically intermittent fish fauna, with four species at low abundance seasonally, but with more diversity in the perennial section downstream. Four fish species were recorded within the River Till including bullhead (an annex II species and one of the primary reasons of the selection of the River Avon SAC) brown trout, and European eel and three-spined stickleback. The overall density and biomass metrics were very low compared to the River Avon. The highest fish density was recorded in the southern reaches of the River Till study area.	County	Medium	Appendix 8.1A, 8.1B and 8.12B	Figure 8.7

Biodiversity Feature	Summary description and rational	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Terrestrial invertebrates	In total, 42 key invertebrate species were identified at eight survey locations. These included two Nationally Scarce Leiodid beetle (*Ptomaphagus varicornis*) and three RDB species: the longhorn beetle (*Paracorymbia fulva*) and the silver-sided nomad bee (*Nomada argentata*). In addition, gnaphosid spider (*Phaeocedus braccatus*), listed as a Nationally Rare species assigned an IUCN Vulnerable threat status was found at Countess Cutting CWS. Although only a single specimen was found in the survey, there is other sparsely vegetated calcareous habitat within the surrounding area that is potentially suitable for the species and it is assumed there is a local population present within suitable habitat. No marsh fritillary larvae were found at Parsonage Down although incidental sightings of adult individuals have been recorded in previous years and during 2018. This may indicate a small surviving breeding population of marsh fritillary butterfly or the start of a re-colonisation of the site.	Local - County	Low - Medium	Appendix 8.1A, 8.1B and 8.11	Figure 8.7
Amphibians (GCN)	A total of 23 water bodies located within the study area were assessed for their potential to support great crested newt (GCN). Of the water bodies surveyed, a single water body (water body 3) located within pasture land approximately 120m from the Scheme was confirmed to contain a breeding population of GCN. The water body had a peak count of ten adults which results in a population size class estimate of 'small' (Ref 8.26). The single small population of GCN recorded along the River Till valley is not considered integral to maintaining populations of GCN within Wiltshire where GCN is common and widespread, it is however important in terms of the Salisbury Plains landscape, where GCN are less common.	Local	Low	Appendix 8.1A, 8.1B, 8.3B and 8.13.	Figure 8.8
Amphibians	Populations of common frog (*Rana temporaria*), common toad (*Bufo bufo*) and smooth newt (*Lissotriton vulgaris*), were identified sporadically throughout the study area. The populations are considered to be moderate examples of common and widespread species.	Site	Less than Low	Appendix 8.1A, 8.1B and 8.13	Figure 8.8

Biodiversity Feature	Summary description and rational	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Reptiles	A small population of viviparous lizard was recorded at Countess Cutting CWS during the 2007 surveys and in a few other road verges/ cuttings, also slow worm. Grass snake was only in riverside grassland in the Till valley. The habitat is considered to be of similar suitability for reptiles within 2018, reptiles are therefore only considered to be present within the limited areas of suitable habitat within the study area, at fairly low densities.	Site	Less than Low - Low	Appendix 8.1A, 8.1B and 8.3B.	Figure 8.9
Birds (breeding and wintering)	The surveys recorded assemblages of notable farmland species including grey partridge, corn bunting (*Emberiza calandra*), skylark (*Alauda arvensis*), lapwing (*Vanellus vanellus*), linnet (*Carduelis cannabina*) and yellowhammer (*Emberiza citrinella*) was recorded across large parts of the study area. Many of these species such as corn bunting are declining nationally (Ref 8.48), and have been lost from many agricultural landscapes altogether. The assemblages of wintering bird recorded within the study area were considered to be typical of the agricultural farmland habitat within the local area and Wiltshire. No large assemblages of important wintering birds were identified during the desk-study.	County	Medium	Appendix 8.1A, 8.1B and 8.15	Not Applicable
Barn owl	Barn owls have been recorded within 11 boxes (breeding status was not confirmed). The population of barn owls within the study area represents up to 4% of the recorded occupied nest boxes in the county. Barn owl road casualties are largely concentrated along the A303 between Longbarrow Roundabout and Amesbury.	County	Medium	Appendix 8.3B	Figure 8.10 Figure 8.11
Stone curlew	In 2016, there were between 320 and 380 breeding pairs of stone curlew within the UK (Ref 8.50). The Salisbury Plains SPA is considered to support approximately 11% of the breeding population of stone curlew within Great Britain. The breeding population present within the study area is considered to be a supporting population of the breeding population in Salisbury Plain SPA.	National	High	Not Applicable	Figure 8.11
Great bustard	Great bustards have been re-introduced on the Salisbury Plain; this population is the only know population within the UK. Nesting sites of this species have been observed as being largely limited to the south of the existing A303.	National	High	Not Applicable	Figure 8.11

Biodiversity Feature	Summary description and rational	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Bat species assemblages	Bat activity was highest along the Till valley and within Amesbury Park and adjacent to the River Avon, with at least 14 species recorded overall from activity surveys and static detectors (including soprano pipistrelle (*Pipistrellus pygmaeus*), common pipistrelle (*Pipistrellus pipistrellus*), serotine (*Eptesicus serotinus*), noctule (*Nyctalus noctula*), Leisler's bat (*Nyctalus leisleri*), brown long-eared bat(*Plecotus auritus*),, Natterer's bat (*Myotis nattereri*) Daubenton's bat (*Myotis daubentonii*), Barbastelle bat (*Barbastella barbastellus*), lesser horseshoe bat (*Rhinolophus hipposideros*) and individual records of greater horseshoe bat (*Rhinolophus ferrumequinum*). Bats were also using the relatively isolated woods at Normanton Copse and Diamond Wood south of the Scheme (Appendix 8.17 and Figure 8.15). Barbastelle bats have been recorded throughout the study area; however, the bat trapping and radio-tagging surveys indicate that Winterbourne Stoke is at the most northerly aspect of their home range (Appendix 8.19). The surveys highlight the importance of the suitable linear features such as hedgerows, byways, river systems and woodland strips as commuting features for bats in a largely exposed and intensively managed landscape.	County - Regional	Medium	Appendix 8.1A, 8.1B and 8.17	Figure 8.14 and 8.14B
Bat roosts	The building and built structures roosting surveys undertaken in 2017 identified four buildings within the Countess Farm complex and a single bridge as being confirmed bat roosts. The species present were common pipistrelle, soprano pipistrelle, brown long-eared bat, Daubenton's bat and Natterer's bat (Figure 8.13). Several tree roosts of Natterer's bat, soprano pipistrelle and other roosts identified within the study area. The baseline surveys suggest that although only individual numbers of tree roosts have been identified within the study area, the potential roost resource (over 170 trees with suitability to support roosting bats) is fairly common even in the generally open habitat of Salisbury Plain (Figure 8.13). No Barbastelle bat roosts have been identified within 100m of the Scheme boundary. Tree roosts have been identified to the south of the Scheme only, mainly along the River Till valley, highlighting the importance of this feature for the species (Appendix 8.19).	Local - County	Low - Medium	Appendix 8.1A, 8.1B, 8.3B and 8.20	Figure 8.13

Biodiversity Feature	Summary description and rational	Importance (Ref 8.4)	Value (Ref 8.1 and 8.5)	Appendix	Figure
Water vole	Water voles were recorded throughout the River Avon study area, and confirmed present within the River Till (Figure8.16). The river systems within the study area are likely to provide a stronghold for water vole, which is considered to be nationally declining.	County	Medium	Appendix 8.1A, 8.1B and 8.22	Figure 8.15
Otter	Otters were recorded to be present within both the River Avon and River Till. The otter evidence within the River Avon, suggests that the river is a stronghold for otter (Figure 8.17). One intermittently used resting place was found within approximately 60m of the Scheme boundary. The section of the River Till within 500m of the Scheme boundary is considered to only be seasonally suitable for otters due to the ephemeral nature of the watercourse. The land within the survey area would only be likely to support a small number of otter territories given their wide-ranging behaviour and their relatively large territory size. Over the last decade otters have extended their range in Wiltshire and are now known to be present along all major watercourses in Wiltshire (Ref 8.53).	County	Medium	Appendix 8.1A, 8.1B, 8.16B and 8.22	Figure 8.16
Badger	Evidence of badger activity was recorded throughout the study area during the field surveys. At least eight social groups are located within 500m of the Scheme boundary. Badgers are widespread and common throughout Wiltshire and the study area (Ref 8.53).	Site	Less than Low	Appendix 8.1A, 8.1B and 8.16B	Figure 8.12
Other species of principal importance	Brown hare (*Lepus europaeus*) and hedgehog (*Erinaceus europaeus*) are widespread and abundant throughout the study area. Harvest mouse (*Micromys minutus*) and polecat (*Mustela putorius*) have been identified within the study area but are suspected to be under-recorded (Ref 8.53).	Site	Less than Low	Appendix 8.1A and 8.1B.	Not Applicable

Future baseline

8.6.13 As detailed within Chapter 4 Environmental Assessment Methodology, in order to identify the effects of the Scheme on biodiversity features, it is important to understand the baseline (at year of construction) and future baseline (at year of opening/ operation), as these may be different.

Construction year baseline (2021)

8.6.14 The baseline provided in the above sections describes the biodiversity features as they were in the years surveyed (2016-2018). The following paragraph describes the anticipated future biodiversity baseline at 2021, which is the assumed start date of construction.

8.6.15 The majority of the land to be impacted by the Scheme has been classified as agricultural land and associated linear boundaries. As such, the biodiversity baseline is unlikely to change significantly by 2021, unless any large-scale changes in agriculture policies and practices occur. The known applications and allocations associated with the provision of residential dwelling (cumulatively approximately 2,000 dwellings) may result in an increase in visitor pressures on the areas surrounding the WHS; this may result in increased disturbance events on breeding stone curlews within Normanton Down RSPB Reserve. The majority of other applications are unlikely to significantly change the biodiversity baseline at 2021.

Opening year baseline (2026)

8.6.16 It is not possible to accurately predict the baseline for the year 2026, however it is anticipated that urban pressures associated with an increased population may result in the expansion of the built environment. Should there be any large-scale changes in agriculture policies and practices, these may result in changes to the land-use surrounding the Scheme. As such, in the absence of the Scheme it is possible that there would be an overall reduction in the extent of the agricultural land in the surrounding landscape. This is unlikely to increase the value of the biodiversity features currently identified. The planned future developments have been taken into consideration during the assessment, for example, changes in future traffic that would affect air quality and hence vegetation.

8.7 Potential impacts

8.7.1 The Scheme has the potential for a range of impacts on important biodiversity features.

8.7.2 Impacts can be either direct or indirect, and/or cumulative as follows:

a) a direct impact is considered to be a direct/ immediate consequence of the Scheme, or particular activity, without any intervening steps. In this instance this is a physical loss or gain of a habitat, or direct mortality/ damage of an individual, or species population;

b) an indirect impact is considered to be an impact of one individual, population, or habitat arising from an impact on an intermediary or as a result of an impact pathway; and

c) a cumulative impact is considered to be the impact resulting from the combination of several schemes or activities together.

8.7.3 The characteristics of these impacts are discussed in relation to important biodiversity features (identified within Section 8.6) in Section 8.9.

8.7.4 The confidence in assessment predictions for the construction and operational phase is provided in the summary Appendix 8.23.

Construction

8.7.5 The majority of potential impacts would arise during the construction phase. The potential impacts associated with construction are based on the construction phase lasting approximately five years. The potential impacts of the Scheme that are likely to relate to important biodiversity features are:

a) **Habitat loss or gain:** These are direct impacts related to the change in land use resulting from the Scheme. This would include vegetation clearance, change in use such as the creation of drainage ponds, habitat creation and enhancement;

b) **Fragmentation of populations or habitats:** Indirect impacts due to breaking up of a habitat, ecosystem, or land-use type into smaller parcels, or the creation of partial or complete barriers to the movement of species, with a consequent impairment of ecological function;

c) **Disturbance:** An indirect impact resulting from a change in normal conditions (light, noise, vibration, human activity) that would result in the important biodiversity feature changing its typical behaviour;

d) **Habitat degradation:** A direct or indirect impact resulting in the reduction in the suitability of the habitat for the identified important receptor (such as the impact of shading, changes in water quality or change in the water regime); and

e) **Species mortality:** A direct impact on a population of a species associated with mortalities due to construction activities.

Operation

8.7.6 The operational phase of the Scheme is considered to be when the Scheme becomes active; as such, all of the potential impacts are associated with the activity of vehicles using the Scheme itself. The potential impacts of the Scheme during the operational phase that are likely to relate to important biodiversity features are:

a) **Species mortality:** A direct impact on a population of a species associated with mortalities from collisions with vehicles, possible pollution incidents and management practices;

b) **Habitat degradation:** An indirect impact resulting in reduction of the suitability of the habitat following construction for the identified important biodiversity features. Generally associated with increased light, noise, vibration and chemical pollution (associated with vehicles being active on the road);

c) **Fragmentation:** An indirect impact resulting in fragmentation of populations of important biodiversity features that are specifically associated with the operational phase, such as light spill associated with active vehicles; and

d) **Disturbance:** An indirect impact resulting from a change in normal conditions (human activity) that would result in the important biodiversity feature changing its typical behaviour, such as changes in roosting behaviour.

8.8 Design, mitigation and enhancement measures

8.8.1 The Scheme incorporates measures that have been embedded into the design to mitigate adverse effects on biodiversity features and compensate for the loss of habitats by the creation of new areas of habitat within the Scheme. It also includes working practices which would avoid impacts and provide mitigation for important biodiversity features during construction and operation. These measures have been identified and developed through the EIA process, including consultation with stakeholders and statutory bodies. The following sections outline the measures and how they would minimise the impact of the Scheme on biodiversity. Details are provided in the Environmental Masterplan (Figure 2.5) and OEMP.

Construction

8.8.2 The Environmental Masterplan (Figure 2.5) illustrates the proposed landscaping of the Scheme, along with additional areas of essential mitigation for biodiversity features that have been incorporated to meet specific species or habitat requirements, in plan (Figure 2.5A-O, and illustrative cross-sections Figure 2.5P). This Environmental Masterplan shows both the mitigation for the anticipated impacts on biodiversity and mitigation measures for other environmental impacts which also enhance biodiversity in the Scheme as required by the OEMP.

Essential mitigation

8.8.3 The essential mitigation would be included in order to avoid/ mitigate for the potential impact as describe within Section 8.7. These are detailed below.

Habitat loss and fragmentation

8.8.4 North south biodiversity connectivity would be retained by crossings of the Scheme by four green bridges that would form part of an ecological network. This would be in addition to the existing A303 conversion to a bridleway and cycleway. All the green bridges would be sown or planted with suitable plant species to facilitate movement of the biodiversity features.

8.8.5 Green Bridge One and Green Bridge Two include bunds and planting. These green bridges would offer sheltered crossing features to reduce mortality and improve connectivity to existing habitat features to aid crossing by bats and other species. Additionally, the B3083 underbridge has been widened to provide an unlit access for farm use and this is expected to facilitate the movement of bats through the underbridge. The hedgerows leading to the underbridge would be enhanced and linked to existing suitable woodland habitat to provide a connective feature between important habitats.

8.8.6 Mitigation to reduce the risk of mortality of birds and bats has been included by having the Scheme in cutting for much of its length and by the provision of false cuttings, typically 2m or more in height, to encourage birds and bats to fly above the height of most vehicles. False cutting extends on both sides of the Scheme from east of the green bridge at Parsonage Down to the B3083 bridge (see Environmental Masterplan, Figure 2.5 and illustrative cross-sections in Figure 2.5P) and continues across the bridge east to where the Scheme would be in cutting before crossing the Till valley.

8.8.7 The habitat within the soft estate has been designed to maintain east west connectivity with creation of a range of habitats to maintain a strong ecological network in order to improve connectivity for a range of species. On both sides of the Scheme the soft estate habitats would form a continuous link from the west end to the Till valley. Beyond the Till crossing, the soft estate would extend uninterrupted along the north side of the Scheme to the merge with the A360 near the Stonehenge visitor centre and on the south side to Longbarrow Junction.

8.8.8 In addition to the green bridges, the design incorporates mammal underpasses that have been located as closely as possible along known badger paths. The inclusion of these features would further aid the retention of north south connectivity for badgers and other SPIs.

8.8.9 Two bat hibernation features have been incorporated into the design of the Scheme, to compensate for the loss of potential bat roosting features associated with the vegetation clearance and to compensate for the loss of an underpass near the eastern portal, which is an important commuting route for bats (Figure 2.5).

Habitat degradation

8.8.10 The River Till viaduct has been designed to minimise the shading impact on the sensitive marginal habitat associated with the river corridor. The viaduct will be a twin-deck structure with each deck being approximately 14m wide, and with a

gap of approximately 7m between the decks. The road level on the viaduct will be approximately 10m above the River Till where it crosses the river channel, which would reduce the shading compared to a lower bridge. The locations of the piers and foundations have been optimised so they are not within the SAC or SSSI. There will be no structure in the river channel and the vegetated banks will be retained during construction. After construction of the viaduct, the area underneath the River Till would be reinstated to its former condition and fenced to avoid impacts of trampling by livestock on the sensitive marginal habitat.

8.8.11 Where hedgerows cannot be retained, either during construction or following landscaping activities, these would be replaced or gaps filled where necessary. This includes the hedgerow running alongside the western abutment of the River Till viaduct and the hedgerow along an existing field boundary north of Green Bridge Two.

8.8.12 Lighting has only been incorporated into the design of the Scheme where it is essential for safety reasons. The current lighting at Countess Roundabout will be improved to minimise light spill to adjacent areas of habitat, notably near the bat roosts at Countess Farm. The existing lit roundabout at Longbarrow will be removed and the new Longbarrow Junction will be in cutting and unlit. There will be no lighting on the green bridges.

8.8.13 The strategy for managing surface water runoff from the road is based on DMRB guidance and includes provision of appropriate measures for treatment to mitigate pollution to likely higher standards than at present. This would minimise any impacts upon the quality of surface water and groundwater and substantially reduce the current impacts caused by drainage gullies and roadside ditches discharging directly to the River Till and River Avon or infiltrating the runoff to ground without treatment.

Enhancement

8.8.14 The creation of chalk grassland between Parsonage Down SSSI and the Scheme to the south is expected to provide connectivity for species to access the new habitats of the Scheme, as well as provide a buffer zone between the A303 and the SSSI. The habitats to be created within the Scheme are anticipated to improve connectivity in an east west direction for species of chalk habitats, by providing ‘stepping stones’ of suitable habitat between the SSSI and other areas. This has the potential to aid dispersal and connectivity of habitats and meta-populations of species at a landscape scale.

8.8.15 One of the aims for biodiversity enhancement is to facilitate the movement and colonisation of invertebrates, such as butterflies, from their core areas of habitat to other existing and new habitats. It is anticipated that habitats created within the Scheme; including the existing A303 being turned into a new ‘green’ byway and the green bridges would re-connect semi-natural habitats within the wider landscape. The green bridges will all contain wildflower grassland, providing sheltered habitat links across the Scheme into adjacent habitats along the soft

estate and adjacent areas (with consideration to Natural England guidance on green bridges (Ref 8.68)).

8.8.16 Chalk bunds on green bridges and areas of the false-cuttings, cuttings and embankments will be seeded and planted with larval food plants for butterflies. Areas of new calcareous grassland will also be included. This has the potential for beneficial impacts on the chalk downland butterflies, which are an interest feature of Parsonage Down SSSI. It would also facilitate the spread of plant species of chalk grassland, helping to connect areas of habitat in an ecological network from west east.

8.8.17 The cuttings will expose the underlying chalk. The vegetation that develops there would be determined by the substrate and profile, the usage of top soil, the selective use of seeding and planting of wildflowers and the management regime. Some of the essential design features of the Scheme offer scope for habitats of other types. For example, basins used to infiltrate the drainage would change land from arable use to semi-natural habitats, although their primary function is drainage. In the eastern section of the Scheme the opportunities for habitat creation will be focused on the slopes of cuttings and along the existing A303, which is being turned into a restricted byway.

8.8.18 The new habitats in the Scheme will be created using chalk substrate and minimal topsoil in order to maintain a nutrient-poor soil suitable for chalk grassland species. The aim is to develop and retain a mosaic of chalk habitats, especially areas with flower-rich, sparse sward and patches of bare ground. Management will be carried out to prevent excessive development of scrub.

8.8.19 The most extensive area for habitat creation will be the area east of Parsonage Down, between Parsonage Down SSSI and the B3083 on the north side of the new A303. It will be substantially re-landscaped using excavated chalk material, then will be progressively developed as a mosaic of semi-natural habitats, predominantly chalk grassland.

8.8.20 This area has the potential to complement and enhance the existing NNR. Being directly adjacent to Parsonage Down SSSI, as it develops it would provide new habitats that can be colonised by species from the SSSI. It would contribute to making the SSSI better connected and better buffered from arable farming. It offers a unique opportunity for people to experience a range of new chalk habitats and existing ones of exceptional quality.

8.8.21 The creation of new habitat would assist in the realisation of Highways England's commitments to identify works that would halt the loss to biodiversity and contribute to the longer-term ambition of no net loss in Road Period 2; such as reviewing opportunities for contributing to restoration areas such as Nature Improvement Areas as part of its 2017 Environment Strategy and in order to contribute towards the Government's aims detailed within the Biodiversity 2020' strategy (Ref 8.57). Suitable management of cuttings and green bridges included in the final design will to be guided by the principles of Natural

England's The Mosaic Approach: Managing Habitats for Species to improve biodiversity, specifically targeting priority habitats and species (Ref 8.58).

Embedded mitigation applied during construction

8.8.22 The majority of potential impacts would arise during the preliminary works and the main construction phase. Construction impacts are assessed with consideration given to the implementation of measures included within the OEMP.

8.8.23 Prior to the construction phase further ecological surveys would be required in order to:

a) update the baseline surveys to avoid impacts on protected species during construction;

8.8.24 The surveys include, but are not limited to:

a) bat landscape scale surveys, commencing two years pre-construction, as per current best practice (Ref 8.32);

b) update bat roost surveys of all trees and buildings within 20m of the Scheme;

c) reptile surveys;

d) GCN surveys of all water bodies within 500m;

e) update badger surveys;

f) otter monitoring surveys of confirmed and potential resting places;

g) updated habitat assessments; and

h) invasive species surveys.

8.8.25 The following avoidance/ mitigation measures have been included and where applicable described in the OEMP (further details are provided in Section 8.9):

a) Where necessary fencing will be used to prevent access to retained important habitat, to protect the habitat, avoid accidental damage or species mortality. This will include areas to which species have been temporarily displaced.

b) Work compound and access tracks will not be located within or adjacent to retained important habitats.

c) To minimise disturbance to environmentally sensitive areas, the location of haulage routes, material storage areas, compounds, generators, lighting and other construction activities will be carefully sited.

d) Works near watercourses will be carried out in accordance with Construction Industry Research and Information Association (CIRIA) guidance, in particular C532 Control of water pollution from construction sites, C650 Environmental Good Practice on Site, and CIRIA C648 Control of water pollution from linear construction projects (detailed within the OEMP).

e) Lighting strategies have been designed to reduce light spill on important biodiversity features, Recommendations to help minimise the impact artificial lighting (Ref 8.59 and 60) (detailed in the OEMP).

f) Disturbance to breeding birds will be avoided by avoiding vegetation clearance/structure demolition during the bird breeding season (typically February to August inclusive). Where this is not possible measures necessary to avoid harm to birds and their nests will be implemented as appropriate under the supervision of an ecological clerk of works.

g) Where a stone curlew nest plot will be lost due to construction activities mitigation measures will be put in place in advance, including deterrence measures where required (as a minimum). A replacement plot will be established in advance of the loss of a plot near Parsonage Down.

h) Due to the presence of setts within the Scheme footprint, it will be necessary to permanently exclude badgers under licence from Natural England (as detailed within the OEMP). The setts will need to be closed under licence prior to construction, and outside of the badger breeding season (i.e. 1 December until 30 of June). None of the setts identified as requiring closure as part of the Scheme are main setts; as such, the creation of any artificial setts is not required.

i) Mitigation will be implemented to avoid injury to badgers and other wildlife present during the works. This will include exclusion measures of badgers and other vertebrate animals from excavations, and if access cannot be prevented, then provision of means for escape from open excavations will be provided.

j) Exclusion areas and other protection will be used as appropriate around sensitive, protected or notable features including all vegetation to be retained, such as trees, woodland and hedgerows; mitigation areas or features for wildlife and any temporarily required areas such as bird nesting sites.

k) Invasive non-native species will be identified prior to works and removed or otherwise managed to prevent their spread.

l) To avoid impacts on fish in the River Till, any piling works will be carried out using low vibration methods and will be excluded from within 8m of the river (as a minimum).

m) The requirement of any Natural England licences and associated working practices will be set out, communicated to staff, implemented and reported.

n) Measures will be included to maintain wildlife dispersal corridors across the Scheme, using culverts, structural planting, retention of habitat, retention of dark corridors along sensitive habitat such as the Till valley area.

o) Monitoring requirements of the protected and notable species and habitats that will be required during the construction phase.

8.8.26 It is considered that accounting for the implementation of measures set out within the OEMP, significant construction impacts to important biodiversity features associated with dust deposition, air pollution, pollution incidents, water quality, light, noise, and vibration would be avoided.

8.8.27 The OEMP also details the requirement for a permanent Ecological Clerk of Works (ECoW) role during the construction phase of the Scheme. The ECoW role will be required to ensure that all measures and methods detailed within this section and the OEMP, including monitoring surveys, are adhered to.

Operation

8.8.28 The Environmental Masterplan (Figure 2.5) and Outline Landscape and Environmental Management Plan (OLEMP) (see Appendix 8.26) illustrate the Scheme along with additional areas of essential mitigation that have been incorporated to meet specific species or habitat requirements. This has been classified as embedded essential mitigation for the anticipated effects; or as enhancement on important biodiversity features where mitigation measures for other environmental impacts have been amended to enhance biodiversity features within the Scheme.

Essential mitigation

8.8.29 The creation of chalk grassland between Parsonage Down SSSI and the Scheme to the south is expected to provide connectivity for species to access the new habitats being created as part of the Scheme, as well as provide a buffer zone between the A303 and the SSSI. This conversion to chalk grassland will remove an existing area from agricultural nitrogen fertilisation and prevent runoff or leaching of up to 0.3kg of nitrogen into the SSSI, for every kilogram of nitrogen fertiliser or manure applied to a field. This would contribute to offsetting any potential increase in atmospheric nitrogen deposition resulting from Scheme nitrous oxide emissions.

8.8.30 The habitats to be created within the Scheme are anticipated to improve connectivity in an east west direction for species, by providing directly connected habitats between areas of habitat and to green bridges. This is to help mitigate for the possible direct mortality effects associated with north south movements of species at a landscape scale.

8.8.31 In order to ensure the habitats establishment, further botanical surveys and habitat condition assessments would be undertaken during the operational stage. Specific post-construction monitoring surveys would be undertaken to:

a) inform the management of habitats and other features of the Scheme; and;

b) confirm whether the mitigation is effective.

8.8.32 The survey requirements would be informed by the surveys undertaken prior to and during construction, and would likely include, but not be limited to:

a) bat crossing point surveys of the important commuting features, in line with current best practice ;

b) bat landscape scale surveys as per current best practice (Ref 8.32);

c) inspections of the newly created bat roosting structures to confirm usage;

d) badger monitoring of incorporated badger/mammal features;

e) stone curlew monitoring of retained breeding plots within 500m of the Scheme, and new created plots;

f) botanical surveys and habitat condition assessment, including chalk grassland and retained and new grassland within the Till valley; and,

g) further surveys of indicator chalk grassland species (such as chalk grassland butterflies) to inform the development of the ecological network.

8.9 Assessment of effects

Introduction to the assessment

8.9.1 The effects have been assessed following consideration of the potential impacts outlined in Section 8.4 and the mitigation measures in Section 8.8. As set out in Section 8.6 and Table 8.12, important biodiversity features have been identified, the potential impacts from the Scheme on those receptors have been described and the effects assessed, based on the Environmental Masterplan (Figure 2.5) and the measures in the Environmental Masterplan Mitigation Schedule (Appendix 2.1) and OEMP. The overall effects (including the embedded mitigation) have been assessed as being adverse (negative), beneficial (positive) or neutral. In accordance with the methodology set out in Table 8.3

and paragraph 8.3.10, only effects significant at a county level (moderate) or greater are determined to be significant for the purpose of this EIA.

8.9.2 Because of the complexity of the assessment, in terms of the number of biodiversity features considered and the range of pathways of potential impact assessed, the key findings of the assessment are briefly summarised here and then described in more detail below for designated sites, habitats and then species.

8.9.3 With the embedded mitigation incorporated, almost all of the effects have been assessed as not significant. These non-significant effects are summarised in a table in Appendix 8.23, but are explained below in this section. None of the statutory designated sites are likely to undergo any significant adverse effects on the features for which they are designated. They are assessed individually in the section below. There is also information provided about the SAC and SPA sites in Appendices 8.24 and 8.25.

8.9.4 The one site for which there would be a significant effect is the Countess Cutting CWS, a small area of chalk grassland, which would be lost due to construction (see paragraphs 8.9.61 and 8.9.63). The site would be replaced by a more extensive adjacent area subsequently. The overall losses and gains of habitats illustrated on the Environmental Masterplan are summarised in Table 8.14 and as described in paragraphs 8.9.46-8.9.71 there would be a net gain of habitats, especially chalk grassland.

8.9.5 To recap the method of the environmental assessment described in Chapter 4 (Methodology, Section 4.5), the assessment of the effects of construction covers the effects on biodiversity features during the construction period to year of opening. It also includes assessment of the expected changes in effects in the period to the assessment year (15 years after opening), specifically in relation to the progressive development of new habitats. In general the benefits of habitat creation are expected to increase as the habitats develop under appropriate management. The Operation section only deals with the effects of traffic movement and human activity once the road is opened, rather than the physical presence of the Scheme (which is dealt with in the Construction section only).

Construction

8.9.6 The majority of potential effects would arise during the construction phase. These are described in the following sections.

Statutory Designated Sites

Chilmark Quarries, Mottisfont Bats and Mell Valley SAC

8.9.7 Three SACs primarily designated for bats were identified within 30km of the centre line of the Scheme. Due to the distance separating the Scheme area from the SACs (all are located over 10km from the Scheme), any foraging or commuting routes present are not considered part of the core roost sustenance

zone for the SACs (Appendix 8.25). As such, the effects of the loss of any suitable foraging or commuting routes associated with the Scheme would not affect the integrity of the SACs, or their ability to support bats (further details are provided within Appendix 8.24 AIES Likely Significant Effects Report).

River Avon SAC

8.9.8 Two sections of the River Avon SAC would be crossed by the Scheme: the River Avon System SSSI east of Amesbury, and the River Till SSSI north of Winterbourne Stoke. Both rivers are individually notified as SSSIs. There are different anticipated impacts on the two rivers, and these are summarised below. Further detailed information on the impact assessment for the SAC is provided within the HRA (Appendix 8.25).

8.9.9 There would be no direct habitat loss associated with the construction activities planned near to the River Avon System SSSI or the River Till SSSI section of the SAC. As such, there would be no direct impacts on these habitats. Construction works on the River Avon bridge would be limited to re-surfacing of the existing A303. Construction of the River Till viaduct and a temporary bridge would be undertaken a minimum of 8m from the River Till channel and outside of the designated area of the SAC.

8.9.10 The potential impacts of construction would be:

a) habitat degradation due to changes in water quality and shading impacts; and

b) disturbance of Annex II species (fish species, e.g. bullhead).

8.9.11 **Habitat degradation:** The potential risk to water quality of the River Till from pollution during construction is anticipated to be somewhat greater than for the River Avon. This is because the crossing of the River Avon involves re-surfacing and maintenance works on the existing bridge, whereas the River Till involves the construction of a new viaduct. There are likely to be works on existing embankments near the River Avon bridge, although this will be outside of the SAC within the existing highway boundary.

8.9.12 Construction activity adjacent to the River Till, but wholly outside the SAC, will involve installing a temporary haul road across the valley, including a temporary single lane bridge; construction of the viaduct itself and associated embankments, removal of the temporary haul route, followed by reinstatement of grassland in the valley.

8.9.13 Control measures incorporated within the OEMP and the integrated design of the Scheme would avoid adverse effects on the SAC. As such, the effect would be neutral.

8.9.14 The proposed viaduct over the River Till has the potential for indirect impacts on the SAC/ SSSI, due to the permanent shading associated with the River Till viaduct. The shading would be expected to result in a variation in aquatic and

terrestrial plant growth. The River Till viaduct would be approximately 10m high over the River Till. To minimise shading of vegetation under the viaduct, the design is a twin-deck structure, with each deck being approximately 14m wide with a gap of approximately 7m between the decks. Variations in the growth of grasses and other plants are expected according to location under the viaduct, due to changes in the shading and micro-climate. Continuity of vegetation within the SSSI would be maintained and hence it would not result in an impact on the integrity of the SAC. As such, the impacts of shading are considered to result in a neutral effect.

8.9.15 There will also be a temporary bridge over the River Till SSSI during the construction phase (approximately two years). The temporary bridge would be a single lane bridge approximately 6m wide, in order to reduce the temporary shading impact on the habitat below. Adverse shading effects on vegetation generally rely on a lengthy period of exposure, typically in excess of two growing seasons or longer. Therefore, the temporary bridge, while it would cause localised shading, it would not be present for long enough to cause an irreversible adverse effect on the integrity of the habitats present within the SAC and SSSI. The short term reversible impact would temporarily affect 6m of the River Till SSSI, which is 12.9km in length. It would result in a neutral effect on the integrity of the biodiversity features of the SAC.

8.9.16 Assessment in the Groundwater Risk Assessment (Appendix 11.4, Section 1.7) predicts negligible changes in flow in the River Avon and the River Till. Hence, no significant effects are expected on biodiversity features.

8.9.17 **Disturbance to Annex II species:** The River Till viaduct will require construction of supports for the viaduct. Short-term disturbance during construction of the supports is not likely to affect spawning of salmon (an Annex II species of the SAC designation) because salmon have not been recorded as breeding in the winterbourne section of the River Till at or upstream of the crossing. Bullhead (Annex II) has been recorded in the section of the river at low abundance. Noise and vibration from construction of the bridge supports would not affect fish if carried out when the river is seasonally dry (as is provisionally planned). It would have the potential to affect behaviour of fish in the immediate vicinity, if it occurred when there was flow in the winterbourne (winter to early summer) (Ref 8.61). Construction of the piers, the nearest of which is more than 8m from the channel, will use low vibration and noise piling methods, as described in the OEMP. As such the disturbance impacts are likely to result in a neutral effect on fish.

8.9.18 No direct impacts on Desmoulin's whorl snail (an Annex II species of the SAC designation) within the River Avon are anticipated as no construction works are planned within or immediately adjacent to the River Avon. The river crossing will be on the existing bridge, which will be re-surfaced. No indirect impacts on Desmoulin's whorl snail populations at the sites downstream of the bridge are anticipated, because the high, stable groundwater on which they depend would not be affected by the construction of the tunnel (see Chapter 11 Road Drainage and the Water Environment). Desmoulin's whorl snail is considered to

be absent from the River Till (Appendix 8.8) so would not be affected by the River Till crossing.

8.9.19 There will be no barrier to the movement of groundwater from the construction of the supports for the River Till viaduct and dewatering would not be necessary for the construction of the supports. Mitigation that has been integrated into the design of the Scheme to avoid impacts from changes in groundwater levels has been outlined in Chapter 11 (Road Drainage and the Water Environment) and the OEMP.

Salisbury Plain SAC

8.9.20 There would be no direct habitat loss in Salisbury Plain SAC as a result of the Scheme. At its closest point the SAC is directly adjacent to the Scheme boundary on both sides of the A303 near Bulford Camp, but the A303 is already dual carriageway there and the only construction would be on side roads, within the highway boundary or within adjacent arable fields. At Rollestone cross, works would be within the highway boundary, outside the SAC and would not involve loss of the scattered scrub along the existing highway boundary.

8.9.21 The potential impacts of construction would be:

a) habitat modification; and

b) habitat degradation due to possible pollution events and dust deposition.

8.9.22 **Habitat modification:** There would be no loss of habitat within Parsonage Down for the construction of the Scheme, though, there would be modification of existing calcareous grassland in 1.2ha of the 21465.94ha of Salisbury Plain SAC to provide a stone curlew nesting plot (see section on Salisbury Plain SPA (paragraph 8.9.27 - 30) and Parsonage Down SSSI/NNR (paragraph 8.9.46 – 49)), but this would not have a likely adverse impact on the designated features or the integrity of the SAC. This would result in an effect considered to be neutral and not significant.

8.9.23 **Habitat degradation:** Construction activities associated with the Scheme may result in an increase of dust deposition. This could affect those parts of the SAC that lie relatively close to the works (i.e. within 200m), by coating vegetation and thus affecting evapotranspiration and photosynthesis. The construction-related impacts would be avoided through the implementation of measures set out in the OEMP which will include dust suppression measures.

8.9.24 There would also be the potential for localised emissions during construction work around junctions along the diversion route or during the closure of minor roads east of the River Avon. The air quality modelling detailed within Chapter 5 Air Quality (Table 5.8 and Appendix 5.3, plus additional description regarding designated sites given in Appendix 8.24, p36-40), forecasts that during the construction phase in 2021 the levels of NOx would not exceed the critical level for vegetation except within 5m of Countess roundabout, where the level is currently exceeded but would be less than this level by 2024 and subsequently,

with or without the Scheme. Furthermore, the vegetation which is one of the reasons for the designation of the River Avon SAC is considered to be phosphate-limited rather than nitrogen-limited. As such, NOx levels associated with the construction phase are unlikely to affect the vegetation within the SAC and would not affect the integrity of the SAC. The effects of NOx deposition are therefore considered to be neutral and not significant.

Salisbury Plain SPA

8.9.25 There would be no direct habitat loss within Salisbury Plain SPA as a result of the Scheme. At its closest points the SPA is located adjacent to the Scheme at two locations at Bulford camp in the eastern part of the Scheme and Rollestone cross (Figure 8.1). The construction activities associated with the Scheme at Rollestone cross are unlikely to result in disturbance to birds in the adjacent SPA, as it is screened by a large area of hawthorn (*Crataegus monogyna*) scrub. Where the SPA is located adjacent to the Scheme boundary at Bulford Camp, minimal construction activities are planned, these will be limited to works within the highways boundary. Additional noise, vibration and lighting impacts are not anticipated at this location.

8.9.26 The potential impacts of construction would be:

a) habitat loss of a supporting population of stone curlew and quail, and

b) disturbance of a supporting population of stone curlew, quail and hobby.

8.9.27 **Habitat loss:** Land take associated with the Winterbourne Stoke bypass will result in the permanent loss of a historically active managed stone curlew breeding plot (outside of the Salisbury Plain SPA). It is expected to be rendered unusable due to land-take for the Winterbourne Stoke bypass and associated disturbance during construction. Although this plot is outside the SPA it is used by the same population of stone curlew that nest within the SPA. The loss of the historically active stone curlew breeding plot (this would impact approximately 0.5% of breeding population of stone curlew within Britain) and may result in the reduced breeding success of the breeding pair that would have typically used this site. The permanent loss of the stone curlew breeding plot may result in reduced breeding because current arable methods do not provide favourable conditions and most of the successful breeding on local farmland is on prepared plots. Although this plot is outside the SPA it is used by the same population of stone curlew as those that nest within the SPA and so a net loss of stone curlew plots would be likely to cause a reduction in breeding opportunities for the species, which could affect the ability of Salisbury Plain SPA to achieve its conservation objectives for the species.

8.9.28 As part of the embedded mitigation of the Scheme a new 1.2ha stone curlew breeding plot would be created within Parsonage Down SSSI and NNR. The new breeding plot would be created, under agreement with Natural England, approximately 500m from the stone curlew breeding plot to be lost, in what is very likely to be the foraging area for the breeding pair on the plot to be lost; as such, it is very likely to be easily discoverable by the birds that breed on the plot

to be lost. The effect of the modification of existing vegetation is described in 8.9.45 - 48 below.

8.9.29 The new plot would be created prior to the construction phase. The local presence of actively used stone curlew plots west of Winterbourne Stoke makes it likely that the proposed new plot would be found and occupied by a breeding pair of stone curlew before or during the construction phase.

8.9.30 A second new stone curlew plot is intended to be delivered on RSPB land within 4km of the SPA, such that the project would result in a net gain in stone curlew plots. The provision of a second plot would provide additional insurance beyond the provision of a single plot. However, this second plot is not yet confirmed and was therefore not taken into account in forming the conclusion of no adverse effects on the integrity of the SPA.

8.9.31 Quail was not identified during the 2016 and 2017 surveys, although incidental sightings have been made in spring 2018. Suitable nesting grassland and arable edge habitat are considered abundant throughout the study area and the Scheme is in the normal breeding distribution for this species. As the number of quail that arrive in the UK on spring migration varies considerably between years, it is possible that quail could breed in suitable habitats within the Scheme boundary. The direct impacts of the temporary loss of limited areas of suitable nesting habitat within the Scheme boundary is unlikely to have an impact on any quail visitors considering the high abundance of suitable nesting habitat in areas surrounding the Scheme boundary.

8.9.32 No habitat considered suitable for hobby will be lost as part of the Scheme.

8.9.33 **Disturbance:** Construction activity (specifically increased human activities) within 500m from any breeding sites has the potential to disturb breeding stone curlew. Frequent prolonged disturbance may result in birds leaving their nests for long periods of time, which may result in an unviable brood or increased losses to predation. Although this is likely to be limited to individual breeding pairs, the temporary disturbance impacts may result in reduced numbers of the limited population in the SPA and surrounding land within 5km of it (considered to represent the supporting population).

8.9.34 A historically active breeding plot is located approximately 300m south of the current A303 west of Winterbourne Stoke. It is screened from the highway by roadside vegetation and the landform and would not be affected either by construction or the removal of traffic from the existing A303. A further breeding plot was recorded approximately 500m south of the current A303 near to the Amesbury Road byway. This would not be likely to be disturbed by the short term works on the minor road.

8.9.35 Established stone curlew plots at Normanton Down are south of the Scheme and more than 500m from the area of works at the western portal and the landform already provides some screening relative to nest plots. Even if there is no closer nesting, there is the potential for birds to be disturbed on occasions if

they are foraging in the area. With only low frequency of occurrence such disturbance would be minor and would not be likely to reduce breeding success and recruitment to the population. Mitigation measures have been provided in the OEMP to avoid the temporary indirect impacts of disturbance on breeding pairs of stone curlew, including the use of visual barriers. The bored tunnel would be constructed more than 10m below ground and noise and vibration from construction would be minimal at the surface and it would not be likely to cause any disturbance to stone curlew or other breeding birds at Normanton Down or in other locations near the route of the bored tunnel.

8.9.36 There will be no separation of plots from associated feeding territory due to construction activity. The loss of limited areas of suitable foraging habitat within the Scheme boundary is unlikely to have an impact on local stone curlew populations, considering the extent of suitable foraging habitat in areas surrounding the Scheme boundary.

8.9.37 The Scheme includes a known historically active hobby breeding site. The site is located approximately 200m south of the Scheme boundary. The breeding site is unlikely to be disturbed as part of the Scheme. No further possible breeding sites were identified during the 2016 and 2017 surveys.

8.9.38 The inclusion of the mitigation outlined above would result in effects that are considered to be neutral and not significant to the conservation objectives and biodiversity integrity of the SPA.

River Avon SSSI

8.9.39 The potential impacts of construction would be:

a) habitat degradation due to changes in water quality; and

b) disturbance of otter and water vole.

8.9.40 The potential construction impacts associated with the River Avon System SSSI are described in the River Avon SAC section (paragraphs 8.9.8 – 11 and 8.9.18). The reasons for the designation of the SSSI are broadly the same as those for the designation as the SAC. Additionally, water vole and otter has also been recorded. Any possible impacts associated with the construction phase of the Scheme on otter and water vole are described in the relevant sections (paragraphs 8.9.157 - 170).

8.9.41 The inclusion of the mitigation outlined in the River Avon SAC section (paragraphs 8.9.13 and 8.9.18) would result in effects that are considered to be neutral and not significant on the River Avon System SSSI.

River Till SSSI

8.9.42 The potential impacts of construction would be:

a) habitat degradation due to changes in water quality and shading impacts; and

b) disturbance of species present.

8.9.43 The potential construction impacts associated with the River Till SSSI are described in the River Avon SAC section (paragraphs 8.9.8 – 19). The reasons for the designation of the SSSI are broadly the same as those for the designation of the SAC. Additionally, the presence of water vole and otter has been recorded in the lower reaches of the River Till. Otter is also a designating feature of the SSSI. Any impacts associated with the construction phase of the Scheme on water vole and otter are described in the relevant species sections (paragraphs 8.9.157 - 170).

8.9.44 The inclusion of the mitigation outlined in the River Avon SAC assessment of effects (paragraphs 8.9.13 – 15, 8.9.17 and 8.9.19) would result in effects that are considered to be neutral and not significant for the additional biodiversity features of the SSSI.

Parsonage Down SSSI

8.9.45 There would be no loss of habitat within Parsonage Down SSSI for the construction of the Scheme, there would be modification of existing calcareous grassland in 1.2ha of the 188ha Parsonage Down SSSI to provide a stone curlew nesting plot. The potential impacts of construction would be:

a) habitat modification; and

b) habitat degradation due to possible pollution events and dust deposition.

8.9.46 **Habitat modification**: A stone curlew breeding plot would be created through the provision of a 1.2ha chalkland scrape within the Salisbury Plain SAC/ Parsonage Down SSSI (as described within paragraphs 8.9.28-30 and 8.9.46 - 49). The creation of the chalk scrape is likely to provide a beneficial impact on the SSSI. The grazing management regime in recent years has been predominantly with longhorn cattle and the sward is now mostly closed grassland, except on parts of the steep Parsonage Bank, making it relatively uniform in structure and with a low proportion of the early successional stages of chalk grassland.

8.9.47 Scraping some of the turf from 1.2ha of the site that was ploughed during World War II and subsequently reinstated, is an opportunity to increase the diversity of the vegetation within the SSSI, by creating bare ground for recolonization and a marginal zone of less frequently managed grassland. It is part of the SSSI described as being “of value for the study of re-colonisation of chalk grassland”. The scrape enclosure (1.2ha in total) would represent less than 5% of the previously ploughed area and 0.6% of the 188ha SSSI.

8.9.48 In the first year this management would represent a minor adverse impact on the existing calcareous grassland within the plot, but without any adverse impact on the biodiversity integrity of the SSSI and the features for which it was designated. In the second and subsequent years there would be potential for benefits for plant species and invertebrates of sparsely vegetated chalk

habitats, as well as creating conditions for stone curlew to nest within a very extensive feeding area. The change would be reversible by natural regeneration if it was required. Turf fragments from the scrape would be transferred concurrently to an area east of Parsonage Down, to start a new area of grassland habitat there.

8.9.49 This would be not beneficial effect at the local level/ slight beneficial effect within the SSSI, but would be a neutral and not significant effect at the larger scale of the Salisbury Plain SAC.

8.9.50 **Habitat degradation:** Increased dust deposition during the construction phase would potentially result in a negative impact on the calcareous habitats that are the primary reason for the designation of the site (as detailed in the Salisbury Plain SAC section, paragraph 8.9.23), but this would be fully mitigated by the requirement for dust suppression during working as stated in the OEMP and the effect of dust on the grassland within the SSSI would be neutral.

8.9.51 The change in NOx deposition from the A303 being moved closer to the southern edge of Parsonage Down SSSI has been assessed within the Salisbury Plain SAC section (paragraph 8.9.24). The effects of dust deposition and changes in NOx levels during construction are considered to be neutral and not significant.

8.9.52 The creation of calcareous grassland between the southern boundary of the SSSI and the A303 will remove the land from arable farming and its associated applications of nitrogen (N) in fertiliser and the indirect impacts of this and other agricultural inputs. In combination, the habitat creation south and east of Parsonage Down would remove arable from approximately 1.6km of the boundaries of the site, approximately 20% of the perimeter, representing enhancement, through an improved buffer zone for the SSSI.

8.9.53 Inclusion of the mitigation outlined within this section would result in effects that are considered to be neutral at year of opening. Progressive development and management of the chalk habitats at the areas and south of Parsonage Down would have the potential for increasing benefits for biodiversity over time. This greater extent of semi-natural habitat would have increasing value as supporting habitat for the SSSI for suitability for many of the species within the SSSI.

Parsonage Down NNR

8.9.54 The potential impacts of construction would be:

a) habitat loss and gain; and

b) habitat degradation due to possible pollution events and dust deposition.

8.9.55 **Habitat loss and gain:** Parsonage Down NNR is partially located within the Scheme boundary, an area of the intensively managed farmland, which supports grazing management within the SSSI. Temporary, direct loss of

approximately 35ha of agriculturally improved grassland within the NNR will occur during the construction phase of the Scheme. Excavated materials will be used on the land within the Scheme boundary in Parsonage Down NNR, as part of the landscape-scale integration of the Scheme. The agriculturally improved land that will be temporarily lost will be replaced with chalk grassland and associated habitats, which would result in a permanent, beneficial impact through the increase in habitat. As such, the Scheme would result in a temporary slight adverse effect associated with habitat loss at the time of opening, followed by a permanent effect at the site scale, but expected to increase to importance at least local scale slight beneficial by the assessment year.

8.9.56 Turf fragments from the area for the new stone curlew plot would be used in the area for chalk habitat creation within the area east of Parsonage Down. Monitoring of vegetation at the new plot and developing at the area east of Parsonage Down would be carried out to inform future action on habitat creation and management at the area east of Parsonage Down.

8.9.57 **Habitat degradation**: Effects on the SAC and SSSI part of the site have been addressed above (paragraphs 8.9.20 – 24 and 8.9.45 – 53). The improved grassland outside the SSSI within the Scheme boundary would be lost. The rest of the agriculturally improved grassland and arable within the NNR would not be affected, due to the requirement for dust suppression during working as detailed in the OEMP.

Yarnbury Castle SSSI

8.9.58 No direct impacts are anticipated as no land take is required from this designated site. Yarnbury Castle SSSI is approximately 60m west of the Scheme boundary, near an existing section of the A303 dual carriageway, so during construction indirect impacts such as increased dust deposition are unlikely. The air quality modelling within Chapter 5 (Air Quality) forecasts that there would be a reduction in NOx levels. These are currently already well below the critical level for vegetation of 30 μgm^{-3}. As such, NOx deposition from construction traffic onto vegetation is considered to be neutral and not significant.

Steeple Langford Down SSSI

8.9.59 No direct impacts on Steeple Langford Down SSSI are anticipated during either the construction or operation phase, as the site is located approximately 700m from the Scheme. The air quality modelling within Chapter 5 (Air Quality) showed that the site would not be adversely affected by future changes in traffic in 2021 or 2026. As such, the effects are considered to be neutral and not significant.

Non-statutory designated sites

8.9.60 A total of eight non-statutory designated sites are located within 500m of the Scheme boundary. The potential impacts associated with the construction phase are detailed below and summarised in Table 8.13. The potential impacts of construction would be habitat loss and gain.

8.9.61 The Scheme will result in the permanent loss of the Countess Cutting CWS, which is designated for the 0.74ha of early successional chalk grassland it supports. It is also known to support terrestrial invertebrate's species.

8.9.62 Parsonage Down CWS is the agriculturally improved grassland and arable within Parsonage Down NNR outside the SSSI. As described in the Parsonage Down NNR section above (paragraphs 8.9.54 – 57), approximately 35ha within the CWS would be temporarily used during construction, followed by the creation of chalk grassland. This would represent an enhancement as the site does not have chalk grassland at present. Countess Farm Swamp CWS would lose a narrow strip of willow scrub next to the highway boundary to provide access during work on the embankments and drainage, approximately 0.17ha, but would not affect the swamp vegetation of the wetland. The effect of the loss of scrub on the site is considered to be neutral and not significant.

Table 8.13: Impacts on CWSs associated with the construction phase

Designated site	Potential impact
Countess Cutting CWS	Habitat loss of the whole CWS. Associated loss of notable invertebrate populations. New, longer chalk cutting created adjacent to the site.
Parsonage Down CWS	Temporary habitat loss of agriculturally improved rotational grassland due to landscape integration. Permanent habitat creation of chalk grassland on the land taken for the Scheme and on adjacent land.
Luxenborough Banks CWS	None – minimal construction activities are planned near the CWS except habitat creation on the former A303. The Scheme would be in tunnel
Countess Farm Swamp CWS	Habitat loss at the southern boundary, in order to integrate the new embankments and drainage. The power-line that would cross the northern part of the site would be installed by directional drilling and so would avoid loss of habitat within the site. The site is crossed by an existing water main but a new connection to it would be made in an adjacent arable field and so avoid temporary loss of habitats (see Chapter 15 Cumulative Effects).
Stonehenge Down CWS	None – minimal construction activities are planned near the CWS except habitat creation on the former A303. The Scheme would be in tunnel.
Normanton Down RSPB Reserve	None – minimal construction activities are planned near the Reserve.
Vinies Farm Meadow CWS	None – The CWS is located over 450m from the Scheme boundary.
Cow Down CWS	None – The CWS is located over 450m from the Scheme boundary.

8.9.63 At the year of opening the loss of the chalk grassland at Countess Cutting would represent a moderate adverse residual effect. The permanent loss would be compensated over time by the creation of chalk grassland in the new cutting between the eastern portal and Countess Junction. There would also be

residual effect on invertebrates (see paragraph 8.9.92 on terrestrial invertebrates below). The landscaping works on the new cutting to the eastern portal would be the start of compensation for the loss of the calcareous grassland at the original site. The new habitat is not expected to be fully established by the year of opening, but progressive development of the grassland is expected to occur over the next 15 years, as was the case when Countess Cutting was created in the 1960s.

Habitats

8.9.64 The potential impacts associated with the construction phase would be:

a) habitat loss and gain; and

b) habitat degradation.

8.9.65 **Habitat loss and gain:** The construction phase of the Scheme would result in habitat losses and gains of both temporary and permanent nature. Permanent gains are classified as habitat created in the Highways England soft estate (or land owned by Highways England) and where habitat has been re-instated. Table 8.14 shows all habitat gains and losses within the Scheme boundary. It does not correspond to the total area of land required for the Scheme because it does not include highway or other built infrastructure. The tally of habitat losses excludes the area of farmland above the bored tunnel, although there may be some minor temporary works to be done there. Ground investigations have already been carried out in the fields above the route of the tunnel, involving drilling core sand in several places, the installation of monitoring boreholes, but works have been short term and localised and the affected parts of the fields have been re-instated. Further ground investigations of this type may be required but are not expected to affect semi-natural habitats and where arable is temporarily disturbed it is re-instated immediately after the investigations. Scheduled monuments that are present within the Scheme boundary would be protected from damage during construction and are also omitted from the measurement of habitats to be lost.

8.9.66 By year of opening, there would be net gain of early successional chalk grassland habitat, because the Winterbourne Stoke bypass and associated soft estate would be in place prior to the year of opening, whereas habitat creation on most of the much more extensive area east of Parsonage Down would be less advanced at that stage. There would be progressive increase in the benefits expected in the period to the assessment year, 15 years after opening. The net gain of 162ha of chalk grassland associated with the cuttings and other areas of the Scheme is expected to result in a residual beneficial effect. Due to the increase in both extent and connectivity, the benefit from the new habitat in the soft estate is expected to be significant at local level by year of opening, and at the county level/ moderate beneficial or more by the assessment year.

8.9.67 The losses and gains of the habitats within the study area considered to be of Local Importance (Low Value) or higher and thus requiring further assessment are summarised after the table.

Table 8.14: Habitat losses and gains associated within the Scheme

Existing Habitat (from Phase 1 habitat survey Figure 8.5)	Value	Habitat loss (ha)	New habitat (from Environmental Masterplan Figure 2.5)	Habitat permanent gain (ha)	Net permanent gain (ha) (gain – loss)
Broadleaved semi-natural woodland	Low	1.52	Woodland (LE2.1)	17.05	10.67
Broadleaved plantation woodland	Less than Low	2.52			
Mixed plantation woodland		2.34			
Sub-total woodland	(As above)	6.38			
Individual trees	Less than Low	Not calculated, see Figure 8.13 for locations	Individual Trees (LE2.4)	0.24	-
Scattered scrub	Less than Low	0.12	Shrub (LE2.6)	15.91	14.73
Dense scrub		1.06			
Sub-total Scrub		1.18			
Calcareous unimproved grassland	Low- Very High	1.24	(grassland in Species Rich Chalk Grassland (LE1.3) will develop to this)	(see below)	-1.24
Semi-improved grassland	Less than Low - Low	7.10	Species Rich Chalk Grassland (LE1.3)	163.81	156.71
Other tall herb - ruderal	Less than Low	0.55	(see LE1.3 and LE2.6)	0	-0.55
Improved grassland	Less than Low	48.47	Land returned to unrestricted agricultural use (arable or improved grassland)	123.25	-168.16
Arable/ cultivated land	Less than Low – Medium (field margins with scarce arable flora)	242.94			
Bare ground	Less than Low	6.39	-	0	-6.39
Linear Habitats	**Value**	**Habitat loss length (km)**	**New habitat (from Environmental Masterplan Figure 2.5)**	**Habitat permanent gain (km)**	**Net permanent gain (km) (gain – loss)**
Hedgerow - native species rich	Less than Low	3.48	Native Species Hedges (LE4.2)	**24.14**	**7.72**
Hedgerow - native species-poor		7.63			

Existing Habitat (from Phase 1 habitat survey Figure 8.5)	Value	Habitat loss (ha)	New habitat (from Environmental Masterplan Figure 2.5)	Habitat permanent gain (ha)	Net permanent gain (ha) (gain – loss)
Defunct hedge - native species-rich		0.83			
Defunct hedge – native species-poor		4.50			
Hedges subtotal		16.42			

8.9.68 The Scheme would lead to the loss of approximately 16ha of semi-natural habitats, of which less than 1ha has been assessed as being of local value. All the other habitats are of value at site scale and would be replaced by similar or better habitats in the Scheme. No irreplaceable habitats would be affected (such as ancient woodland or veteran trees). There would also be loss of approximately 291ha of arable and agriculturally improved grassland, although approximately 118ha would be returned to unrestricted agriculture, which would largely be arable.

8.9.69 Although the Scheme would cross the Rivers Avon and Till, there would be no loss of the watercourses. The vegetated banks and channel of the River Till would be retained and protected throughout construction.

8.9.70 As shown on the Environmental Masterplan (Figure 2.5), there would be approximately 203ha of new habitats, mainly chalk grassland (162ha), which would be present and developing at the year of opening (2026) and these would be more established by the assessment 15 years after opening. The area of chalk grassland and associated habitats (excluding woodland) at the area east of Parsonage Down would be approximately 71ha.

8.9.71 The OLEMP sets out the requirement for management to limit natural succession and maintain the target diversity of composition and structure of chalk grassland. The type and frequency of management has a significant influence on the structure and composition of chalk grassland. Within the soft estate the preferred management for the chalk grassland is periodic or low intensity management by sheep (where possible). Whilst there are physical and safety constraints on the areas that can be managed in this way, where practicable, fencing and water for stock would be included to facilitate this type of management. On the highway verges and other areas where grazing cannot be achieved, management would be by mowing, with control of scrub by cutting and by selective use of herbicide as necessary to maintain biodiversity.

8.9.72 The chalk grassland of the Scheme would enhance the west east connectivity, improving the ecological network along the whole length from Yarnbury Castle to Amesbury.

8.9.73 Overall, there would be a net gain of approximately 186ha of semi-natural habitats in the soft estate and the area east of Parsonage Down, mainly chalk grassland. Over time, this would contribute to enhancing the natural environment locally by providing net gains for biodiversity, and by establishing coherent ecological networks that are more resilient to current and future pressures.

8.9.74 **Habitat degradation:** Temporary indirect impacts associated with dust deposition during the construction phase in dry spells. This would be avoided by the dust suppression methods set out in the OEMP. No significant, short term or long term, impacts are therefore anticipated. The effects are therefore considered neutral, and not significant.

Lichen

8.9.75 The lichen assemblage associated with the Stonehenge stones have been assessed as being of National Importance/ High Value. The lichen assemblages present within other areas were assessed as being of Site Importance/ Less than Low Value; as such, they have not been assessed further.

8.9.76 No direct impacts on lichen communities are anticipated as part of the Scheme. There may be habitat degradation impacts during construction, as detailed below.

8.9.77 **Habitat degradation:** Temporary indirect impacts associated with dust deposition during the construction phase in dry spells. This would be avoided by the dust suppression methods set out in the OEMP. No significant, short term or long term, impacts are therefore anticipated.

8.9.78 The residual effects are considered to be neutral and not significant.

Aquatic macro-invertebrates

8.9.79 The aquatic macro-invertebrate assemblages within the River Avon and the River Till in the study area have been assessed as being of County Importance/ Moderate Value.

8.9.80 No direct impacts on macro-invertebrates in the River Avon are anticipated. The River Avon crossing would be on the existing bridge. The only construction activity that is to occur in this area is resurfacing of the existing A303.

8.9.81 No additional outfall locations into the River Avon or the River Till have been included as part of the Scheme and the improved drainage system is expected to lead to better quality of water infiltrating groundwater.

8.9.82 During the construction phase there will be no works within the River Till channels associated with the River Till viaduct construction. As such, no loss of aquatic habitat is expected.

8.9.83 No temporary pools with potential to support fairy shrimp will be lost from the Scheme.

8.9.84 **Habitat degradation:** Runoff of substrate associated with the construction of the River Till viaduct and the associated infrastructure (the temporary bridge) may result in increased siltation of the River Till watercourse when the River Till becomes seasonally wet. This could result in the temporary reduction of macro-invertebrate abundance and diversity. This would be avoided through the methods set out in the OEMP to manage surface drainage during construction.

8.9.85 Shading from the River Till viaduct and temporary bridge structure is not expected to lead to loss of the seasonally inundated vegetation of the River Till (see River Avon SAC impacts, paragraph 8.9.14 - 15) and is unlikely to adversely the assemblage of macro-invertebrates in the River Till. The hydrogeological assessment (Chapter 11 Road Drainage and the Water Environment) indicates that groundwater flow into the Rivers Till and Avon would not be impacted by the construction of the tunnel, so no change is expected in the hydrological regime of either river. Hence no reduction in water quality is expected due to reduced dilution of pollutants and assemblages of aquatic invertebrate species are not expected to change due to the Scheme.

8.9.86 The inclusion of the mitigation outlined above would result in effects that are considered to be neutral and not significant.

Desmoulin's whorl snail

8.9.87 The population of Desmoulin's whorl snail within the River Avon were assessed as being of National Importance/ High Value.

8.9.88 The likely impacts and effects of the Scheme on Desmoulin's whorl snail have been assessed within the River Avon SAC Section (paragraph 8.9.18).

8.9.89 The inclusion of the embedded mitigation outlined within the SAC section (paragraphs 8.9.8 – 19) would result in effects that are considered to be neutral and not significant.

Terrestrial invertebrates

8.9.90 The assemblages of terrestrial invertebrates within Countess Cutting CWS, the River Till, Parsonage Down and on the best arable sites were assessed as being of County Importance/ Medium Value. The terrestrial invertebrate assemblages within the other areas were considered to be of Local – County Importance/ Low -Medium Value.

8.9.91 The potential impacts associated with the construction phase would be:

a) habitat loss and gain;

b) habitat degradation; and

c) habitat fragmentation.

8.9.92 **Habitat loss:** The Scheme will result in the direct, permanent loss of Countess Cutting CWS. The site is known to support seven nationally scarce species and

one vulnerable/ nationally rare species, the gnaphosid spider (*Phaeocedus braccatus*). The gnaphosid spider is a species of warm, sparsely vegetated calcareous grassland and heaths. Countess Cutting CWS will be replaced by the new south facing cutting adjacent to eastern portal, where sparsely vegetated calcareous grassland is expected to develop within three to five years, but there is no adjacent calcareous grassland to provide habitat during the construction period and hence reduction or loss of the notable species may occur. The impact on invertebrate species at Countess Cutting would be partially mitigated by the provision of suitable mosaic habitat that is to be created for reptiles adjacent to the area to be lost (Figure 2.5). The habitat creation will be undertaken prior to the removal of Countess Cutting CWS. The habitat creation will include suitable features for gnaphosid spider, such as areas of bare earth, and stone piles. Furthermore, during the vegetation clearance at Countess Cutting, offcuts and topsoil from the CWS will be translocated into the reptile habitat creation area. The effect on terrestrial invertebrates (specifically the Nationally Rare gnaphosid spider) associated with of the loss of the CWS is therefore likely to be direct, temporary (up to three to five years), adverse at the local level/ slight adverse.

8.9.93 **Habitat degradation:** The proposed viaduct over the River Till has the potential to result in indirect impacts on the habitats adjacent to the river channel, due to the permanent shading associated with the River Till viaduct described in the River Avon SAC impacts section (paragraphs 8.9.14). The Scheme would result in a neutral effect that is not significant.

8.9.94 **Habitat fragmentation:** The Scheme may result in a north to south fragmentation of suitable continuous invertebrate habitat where the Scheme has not been diverted into tunnel. This could lead to the local extinctions of species assemblages. The inclusion of chalk cuttings for successional chalk grassland along the soft estate, and the conversion of the existing A303 to a byway and associated chalk grassland habitat would connect areas of suitable invertebrate habitat in an ecological network from west to east. The inclusion of the four green bridges, the diversion of the A303 into tunnel and the creation of the River Till viaduct would reduce the fragmentation impacts by assisting the north to south migration of terrestrial invertebrates. It is considered that the creation of suitable invertebrate habitats would result in a neutral – slight permanent beneficial effect and not significant on locally prevalent terrestrial invertebrate assemblage, as it would contribute to the linking ecological networks.

Fish

8.9.95 The assemblage of fish species within the River Till has been assessed as being up to County Importance/ Medium Value. The assemblage of fish species within the River Avon have been assessed as being of National Importance/ High Value.

8.9.96 No direct impacts on fish within the River Avon are anticipated, as no construction works are required within the River Avon. The river crossing will be contained fully on the existing bridge and the only construction activities planned to occur is resurfacing of the existing A303. No direct impacts on fish

within the River Till are anticipated as no construction works are anticipated within 8m of the River Till banks.

8.9.97 The potential impacts associated with the construction phase would be:

a) habitat degradation; and

b) disturbance.

8.9.98 **Habitat degradation:** Indirect impacts could arise from pollution incidents and siltation from runoff into the river during the construction phase, if this occurred it would potentially have impacts on potential fish spawning sites downstream of the works.

8.9.99 The implementation of pollution prevention best practice described in the OEMP and within the River Avon SAC impacts section (paragraphs 8.9.8 – 19) would minimise the potential of a likely adverse impact on the fish assemblages present.

8.9.100 It is considered unlikely that the shading from the River Till viaduct would have an adverse impact on fish species present within the River Till corridor during the ephemeral wet season. The fish species that may be present within the river channel are typical of partially tree-shaded river habitats and no spawning sites have been identified within the area to be shaded, therefore the effect is considered to be neutral and not significant.

8.9.101 **Disturbance:** The River Till viaduct will require construction of supports for the viaduct. Short-term disturbance during construction of the supports is unlikely to affect spawning of salmon and brown trout which are located downstream within the River Till, as described in the River Avon SAC impacts section (paragraph 8.9.17). The measures described in the OEMP requiring low noise methods to avoid adverse impact on fish in the River Till would mitigate for both the Annex II species referred in the section on River Avon SAC (paragraph 8.9.17.) and the other species of fish. As stated previously, this mitigation would only be required when there is flow in the River Till, as fish are absent from the area affected by the Scheme and unable to move through it when the winterbourne is in its annual dry period.

8.9.102 The inclusion of the mitigation set out in the OEMP and Chapter 11 (Road Drainage and the Water Environment) are anticipated to result in a neutral effect that is not significant.

Amphibians

8.9.103 The single small population of GCN recorded along the River Till valley was assessed as being of Local Importance/ Low Value. The assemblages of other species of amphibians within the study area were assessed as being of site importance/ less than low, and were not assessed further.

8.9.104 The potential impacts associated with the construction phase would be:

a) habitat loss;

b) direct mortality; and

c) habitat fragmentation

8.9.105 **Habitat loss:** The Scheme will not result in the loss of any water bodies known to support GCN. A single water body known to contain a small-medium population of GCN is located approximately 150m northwest of the Scheme. The Scheme will result in the temporary loss of up to 0.2ha of intensively managed arable field within 250m of the breeding pond and 7ha of intensively managed arable fields within 250-500m of the breeding pond. The temporary loss of habitat is unlikely to have an effect on the favourable conservation status of the small population of GCN, as the habitat loss would be limited to habitat considered to be outside of the core terrestrial habitat (Ref 8.63). The core area is the surrounding pasture and the woodland and hedgerow c. 30m north of the pond.

8.9.106 The Environmental Masterplan (Figure 2.5) includes shrub planting and grassland on the highway embankment. There will also be a drainage infiltration area which would only hold water for short spells and would have largely dry grassland. A water body at the upstream end of the infiltration area is expected to hold water for longer and is likely to support some inundation grassland and other plants of pond margins. The creation of the infiltration area is not considered to result in a significant impact on GCN. It will provide new semi-natural grassland, but the primary function is provision of Scheme drainage and it is not expected to hold water long enough to support a new breeding population of GCN. The effects are considered to be neutral and not significant.

8.9.107 **Direct mortality:** the limited construction activities located within 250m of the breeding pond could result in the killing, injury and disturbance of individual GCN during the terrestrial phase of their lifecycle. However, the risk is low, such that it is not considered necessary to undertake the works under a European Protected Species licence. Suitable working methods have been incorporated into the OEMP that would avoid the likelihood of damage or mortality impacts. The effects are considered to be neutral and not significant.

8.9.108 **Habitat fragmentation:** The construction of the River Till viaduct may result in a partial temporary barrier to southward movement of GCN. Due to the lack of other breeding ponds to the south of the GCN breeding pond, it is considered unlikely that individuals would disperse in this direction to other sites. Furthermore, there would be no construction in the River Till or within 8m of it, so there would be a southward route of semi-natural vegetation for passage of GCN throughout the construction period. It is therefore unlikely that the construction of the Scheme would result in a temporary barrier to GCN dispersal from the known breeding pond. The inclusion of the mitigation outlined above would result in effects that are considered to be neutral and not significant.

Reptiles

8.9.109 The assemblage of reptile species within the study area has been assessed as being of Site Importance/ Less than Low Value.

8.9.110 The potential impacts associated with the construction phase would be:

a) habitat loss;

b) direct mortality;

c) habitat fragmentation; and

d) habitat degradation.

8.9.111 **Habitat loss:** The Scheme would result in the loss of semi-natural habitat considered suitable to support reptiles, particularly the edges of the arable fields, hedgerows and suitable grassland areas such as the areas of soft estate within the Countess Cutting CWS. The area of suitable habitat to be lost as part of the Scheme is considered to be minimal, as generally the current A303 soft estate is very narrow and lacking in the suitable structure to be suitable to support more than a few individuals of each species.

8.9.112 The habitat lost as part of the vegetation clearance would be offset by the creation of a more diverse mosaic of habitat within the Scheme.

8.9.113 **Direct mortality:** Small numbers of widespread reptile species were recorded sporadically throughout the study area. In the absence of mitigation activities such as the vegetation clearance, stockpiling of equipment and materials has the potential to harm or kill reptiles. When disturbed, reptiles frequently bury themselves beneath vegetation to evade predation. The latter response to predation makes them particularly vulnerable to being crushed by heavy machinery.

8.9.114 Where optimal habitat is to be impacted, further pre-construction reptile surveys may be required in order to determine the species presence and likely number of individuals that would be impacted. Avoidance and mitigation measures have been set out in the OEMP this includes a phased habitat clearance in a directional manner, to encourage reptiles to move into surrounding habitats. During the construction phase a habitat area located near to the proposed eastern tunnel portal will be managed as a temporary habitat for any reptiles that have been displaced from Countess Cutting. The inclusion of the mitigation outlined above would result in effects that are considered to be neutral and not significant.

8.9.115 **Habitat fragmentation:** The Scheme may also result in the fragmentation of habitat. This can be particularly detrimental in marginal areas where suitable habitat is often limited. Small populations are intrinsically at greater risk of localised extirpation; further habitat fragmentation is likely to exacerbate this.

The impact of the northsouth fragmentation will be offset by the creation of a more diverse mosaic of habitat within the Scheme.

8.9.116 **Habitat degradation:** The construction of the River Till viaduct, and the resulted shading, is unlikely to affect the status of viviparous lizard and grass snake that occur in the area. Both species are highly mobile and can respond to the changes in shading and temperature hourly to daily. Furthermore, during warm periods, the grass snake becomes more crepuscular/ nocturnal, negating the effects of shading.

8.9.117 The creation of new grassland and where the existing A303 is being turned into a new 'green' byway and the other new public rights of way is likely to have in a positive impact on populations of reptiles. Suitable habitat is often the limiting factor in arable landscapes; it is often restricted in both abundance and distribution. The creation of high quality habitat, on the scale proposed, is likely to connect existing reptile populations and provide opportunities for expansion. Reptiles are able to rapidly colonise new areas provided that the habitat is suitable (Ref 8.64).

8.9.118 The successful implementation of measures to negate killing or injuring reptiles is likely to result in neutral and not significant residual effects during construction and the benefits of habitat creation are likely to increase over time.

Birds (breeding and wintering)

8.9.119 This section assesses the general assemblage of birds. Some species, such as stone curlew, great bustard and barn owl, are assessed separately. The assemblage of farmland bird species within the study area was assessed as being of County Importance/ Medium Value.

8.9.120 The potential impacts associated with the construction phase would be:

a) habitat loss;

b) direct mortality; and

c) habitat degradation.

8.9.121 **Habitat loss:** The majority of territories recorded during the 2017 surveys (Appendix 8.15) were located to the south of the study area. Of the notable farmland species territories recorded during the 2017 survey, only 14 skylark, 16 corn bunting, 12 yellowhammer and seven linnet territories were identified in, or within 100m of the Scheme boundary. The temporary loss of habitat during the construction phase would be offset by the permanent increase in suitable breeding habitat that would be created as part of the Scheme. In the absence of mitigation, vegetation clearance activities undertaken during the primary bird nesting season (March to August inclusive) may result in the damage and destruction of active birds' nests and the possible harm to young birds that have not yet fledged.

8.9.122 In addition, the removal of up to 32km of hedgerow (16km of which was considered to be defunct and species poor), 1.5ha of scrub and 243ha of arable farmland habitat within the Scheme boundary would reduce the amount of breeding and wintering foraging habitat throughout the duration of construction. Species nesting nearby within the study area, but beyond the Scheme boundary, for example starlings, may adapt their foraging behaviour and continue to breed as successfully as prior to commencement of construction. Others such as skylark may be displaced from breeding territories and may occur in reduced numbers because suitable habitat is already well used by breeding pairs. During construction temporary topsoil storage heaps, retained margins and temporary fallow land would provide some opportunities for foraging and nesting, which would help compensate for the negative impacts of habitat loss. In the extensive area of farmland within the wider landscape and the dominant influence of arable management on availability of nest sites and food availability for farmland birds. The loss of mainly arable land and small areas of semi-natural habitat during construction would have a temporary negative impact on breeding birds at a site to local level/ slight adverse, but would not be likely to adversely affect the local conservation status of farmland birds. Wintering birds of arable farmland range widely across the landscape to access localised, seasonal food resources and populations are not likely to be adversely affected.

8.9.123 Overall, the habitat lost as part of the vegetation clearance would be offset by the creation of a much more extensive and more diverse mosaic of semi-natural habitats within the Scheme boundary, providing benefits of additional foraging and nesting opportunities compared to the intensive agricultural cropping. The effects at year of opening are neutral and not significant. Benefits of the new habitats for birds are expected to increase over time as habitats develop.

8.9.124 The banks of the River Till near to the Scheme boundary are not considered to be suitable for kingfisher burrows. No construction activities are planned to occur on the River Avon or River Till banks; as such, no impacts to nesting kingfishers are considered likely. As such, the effects are neutral and not significant.

8.9.125 A known historically active hobby breeding site is located approximately 200m south of the Scheme boundary. During the 2016 and 2017 surveys this site was not active and no further possible breeding sites were identified. Therefore, no adverse impact is expected on this species; as such, the effects are neutral and not significant.

8.9.126 Quail were not recorded during the 2016 or 2017 surveys; however as the number of quail which migrate to the UK in the spring varies considerably between years it is possible that quail could breed in suitable habitats within the Scheme boundary. Due to the extent of suitable nesting habitat in areas surrounding the Scheme boundary, the loss of limited areas of suitable nesting and foraging habitat within the Scheme boundary is unlikely to have an impact on quail population size.

8.9.127 Due to the limited area of the semi-natural habitat to be affected and the ample arable habitat present in the local area, it is considered likely that the loss of suitable habitat would not result in an adverse effect and would be considered as neutral and not significant

8.9.128 **Direct mortality:** In the absence of mitigation, vegetation clearance activities undertaken during the bird nesting season (March to August inclusive) may result in the damage and destruction of active birds' nests and harm to young birds that have not yet fledged. Significant impacts on breeding birds would be avoided through the working methods set out in the OEMP, which would restrict vegetation clearance activities to outside of the breeding bird season where possible and would provide protection for birds and their nests throughout the construction period.

8.9.129 **Habitat degradation:** Retained habitat near to the Scheme boundary may also be temporarily degraded in terms of its suitability for nesting and wintering birds. Noise levels would increase overall, and some are likely to be irregular in occurrence, meaning that birds are less likely to become habituated to them, although habituation is more likely where there is frequent or continuous noise or activity. Visual disturbance may also reduce the suitability of habitat; however this is likely to impact only a limited number of ground-nesting bird species such as skylark and lapwing. Except for parts of the Winterbourne Stoke bypass, much of the area close to the Scheme is already adjacent to an existing major road, so the increase in the level of disturbance during construction is considered to be relatively limited. It is considered that the increase in disturbance due to construction is likely to result in a temporary adverse impact at the site level. The effect is therefore considered to be neutral and not significant.

Barn owl

8.9.130 The population of barn owl within the study area have been assessed as being of County Importance/ Medium Value.

8.9.131 The potential impacts of construction would be:

a) habitat loss or gain;

b) disturbance from noise and lights; and

c) fragmentation.

8.9.132 No known nest/ breeding sites are expected to be lost during the construction phase. A total of 10 known breeding sites were identified within 2km of the Scheme where the Scheme is not in tunnel (Figure 8.11). Of these the closest site is approximately 1.1km from the central line of the proposed A303 (although approximately 150m from the Scheme boundary).

8.9.133 **Habitat Loss:** Construction activities would result in direct temporary and permanent habitat loss. Where existing field boundaries and soft estate are lost

or severed this would result in the reduction and degradation of suitable foraging areas within a barn owls home range. A total of approximately 9ha of optimal foraging areas (Type 1) and 13ha of sub-optimal foraging area (Type 2) would be lost or heavily disturbed due to the Scheme (Appendix 8.1B). It is unlikely that the temporary habitat loss would impact the local population due to the large expanse of suitable habitat within the surrounding area (Figure 8.10). The conversion of the existing A303 into a byway and the associated habitat that will be created where the current A303 is diverted into a tunnel will result in an increase of suitable foraging habitat. The habitat creation would ensure that there is no net loss of suitable foraging habitat.

8.9.134 **Disturbance:** Overnight working practices associated with the construction phase of the Scheme will require lighting which may disturb foraging barn owls within certain areas of their home range. It is unlikely that nesting barn owls would be disturbed during the construction phase, as the closest historically active nesting site is located over 100m from the Scheme boundary and is screened by a line of large mature trees (Figure 8.11). Possible temporary increased noise impacts associated with overnight works may cause some disturbance to foraging behaviour but is unlikely to reduce their foraging success because the hearing of owls is attuned to the high-pitched sounds of small mammals, rather than lower frequency noise from construction. The working practices set out in the OEMP would limit the amount of light, noise and vibration levels, as well as restrict the amount of night time working in sensitive areas.

8.9.135 **Fragmentation:** The construction of the Scheme may result in permanent habitat severance. This would only occur to the west of Longbarrow Junction, where the Scheme is not in a tunnel. The incorporation of the River Till viaduct and the landscaping in Parsonage Down is considered to fully mitigate for the severance impact.

8.9.136 Putting the A303 in a tunnel and the conversion of the existing A303 to a public right of way for non-motorised users would result in the permanent reduction of the severance impacts on movements of barn owl associated with the current A303.

8.9.137 The proposed mitigation is likely to result in a positive, permanent effect on barn owls at the local level/ slight beneficial. This effect is not considered significant.

Stone curlew

8.9.138 The breeding population of stone curlew within the study area is considered to be of National Importance/ High Value.

8.9.139 The potential impacts of construction and mitigation measures are described in in the Salisbury Plain SPA section (paragraphs 8.9.25 – 38). In summary the impacts would be:

a) habitat loss or gain; and

b) disturbance from noise, vibration, lights and increased human activities.

8.9.140 The proposed mitigation outlined within the Salisbury Plain SPA section (paragraphs 8.9.25 – 38) is likely to result in a neutral and not significant effect on stone curlew.

Great bustard

8.9.141 The population of great bustard within the study area has been assessed as being of National Importance/ High Value.

8.9.142 The potential impacts of construction would be:

a) habitat loss or gain; and

b) disturbance from noise, vibration, and lights.

8.9.143 **Habitat loss or gain:** The Scheme would result in the loss of suitable open grassland/ arable land for great bustard. Due to the limited size of the areas due to be affected (243ha of arable farmland) and the ample suitable alternative habitat present in the local area it is considered likely that the temporary loss of suitable habitat would result in a neutral residual effect.

8.9.144 **Disturbance:** Given that the area affected by the Scheme is already an existing major road or adjacent to an existing major road, the increase in the level of disturbance due to construction is expected to be limited. It is considered that the increase in disturbance due to construction is likely to result in a temporary adverse impact that would result in a neutral effect that is not significant.

Bats

8.9.145 The assemblage of bat species (excluding the Barbastelle population) within the study area has been assessed as being of County Importance/ Medium Value. The population of Barbastelle was assessed as being of County - Regional Importance/ Medium Value.

8.9.146 The majority of the identified roosts within the study area contain widespread and common species and are considered to be of Local Importance/ Low Value, with the exception of the large Daubenton's bat maternity roost, which is considered to be of County Importance/ Medium Value.

8.9.147 The potential impacts of construction would be:

a) habitat loss or gain;

b) disturbance from noise, vibration, and lights; and

c) habitat fragmentation.

8.9.148 **Habitat loss or gain:** The Scheme will not result in the loss of any confirmed bat roosts. A total of five trees that are considered to be suitable for roosting bats (these support potential roosting features that may be suitable as both

summer and hibernation roosts) would be lost as part of the Scheme, two of which are considered to be of 'high suitability' to support roosting bats, and the remaining two are considered to be of 'low suitability'. Although the A303 River Avon bridge (a known bat roost) is located fully within the Scheme boundary, no construction works are anticipated on the bridge structure itself and the existing roost would not be affected. As such, no roosts are expected to be lost as part of the Scheme.

8.9.149 The embedded design includes the provision of two bat hibernacula, one near Vespasian's Camp within the site of the underpass and the other near the River Till. Both areas were associated with relatively high levels of bat activity during the 2016 and 2017 surveys. These features are not being provided in compensation for the loss of existing bat roosts, as no confirmed roosts will be lost. They are part of a wider package of mitigation and enhancement for ecological network connectivity for bats. Nonetheless, they will be designed to provide suitable roosting features for the species identified within the study area. The provision of these artificial roosts would increase the potential roosting features within what is currently a largely open landscape with limited roosting and hibernation opportunities so the loss of trees that are considered to be suitable as roosts would not be expected to reduce the availability of potential roosting features in the study area.

8.9.150 The construction of the Scheme would result in the permanent loss of foraging areas, particularly at the western section of the Scheme. Where possible important foraging features, such as 'Grant's Hedge' located to the west of Longbarrow Junction will be retained within the construction site compounds. The habitat creation included in the Environmental Masterplan (Figure 2.5), and Environmental Masterplan Mitigation Schedule (Appendix 2.1) is likely to result in a net gain of a linked mosaic of higher quality habitats in a landscape that currently lacks suitable habitat due to its exposed nature.

8.9.151 The Scheme is considered to result in a temporary negative impact associated loss of several mature trees that contain potential roosting features that are considered suitable to support roosting bats, (although no roosts have been confirmed). The loss of the potential roosting features has been compensated, through habitat creation with a long-term permanent positive impact, at the local level/ slight beneficial. This effect is not considered to be significant.

8.9.152 **Disturbance:** Activities resulting in increased levels of noise, vibration or light can lead to bats abandoning roosts. Bats are susceptible to disturbance impacts during the sensitive hibernation and maternity period. The Countess Farm complex is located within 20m of the Scheme (at its closest point). The complex is a multi-species roost, supporting day/ occasional roosts of common and soprano pipistrelle, brown long-eared bat, and Natterer's bat. It also supports a brown long-eared maternity roost. It is likely that the bats using the features are habituated to the high levels of light and noise, as the roosts are currently near to the existing Countess Roundabout. Commuting and foraging bats may also be disturbed by increased noise and light levels during the construction period. Working measures detailed in the OEMP would reduce any disturbance impacts

as a result of construction activity to acceptable levels for the adjacent residential properties. The OEMP would also include measures to avoid light spill on any important commuting routes or foraging areas. With the mitigation set out in the OEMP, possible disturbance impacts would be negative at a local level/ slight adverse. This is not considered to be significant.

8.9.153 **Habitat fragmentation:** The construction of the Scheme would result in the fragmentation of important commuting routes between roosts or foraging areas, where the Scheme is not in the tunnel. A number of important north south commuting routes are bisected by the Scheme. Of particular note is the connective feature between Scotland Lodge and Parsonage Down, the footpath adjacent to the River Till, and the underpass at Vespasian's Camp. Mitigation measures to reduce the impacts associated with fragmentation include the following:

a) Green Bridge One and associated structural planting at Scotland Lodge;

b) Green Bridge Two;

c) B3083 underbridge; and

d) the River Till viaduct will avoid any fragmentation impacts on the commuting route running along the River Till valley.

8.9.154 It was not possible to include into the design a crossing feature near to the underpass adjacent to Vespasian's Camp due to the topography of the surrounding ground and the Scheme. However, the conversion of the existing A303 to byway is likely to result in the permanent reduction of the fragmentation impacts associated with the current A303. Given that the area affected by the Scheme is already an existing major road, or adjacent to an existing major road, the proposed habitat creation detailed in the Environmental Masterplan (Figure 2.5) will improve the east west connectivity and reduce the current north south fragmentation impacts associated with the current A303. The Environmental Masterplan includes the creation of a linked mosaic of higher quality habitats, including drainage swales, hedgerows, and infiltration areas that will further increase the foraging habitat to the north and south of the Scheme, further reducing the likely fragmentation impacts.

8.9.155 The temporary habitat loss would result fragmentation of habitats, which would result a temporary negative impact during construction at the local level/ slight adverse. This would be mitigated by the construction of green bridges and the bunds on them which link to adjacent features used by bats; by false cuttings and by planting selected areas with scrub and trees. By the assessment year, 15 years after opening, the maturation of the habitat is expected to result in a benefit at the local level/ slight beneficial. This is not considered to be significant.

8.9.156 Additional monitoring has been specified as per current best practice (Ref 8.32) to verify these effects on bats. The monitoring requirements aim to replicate the

pre-construction baseline in order to assess the effectiveness of the mitigation features. This will include crossing point surveys of the above mentioned green bridges/ underbridge and where the existing A303 is diverted into tunnel. The surveys as mentioned in Section 8.8 (paragraph 8.8.25) will follow the methodology set out within Appendix 8.18. Further landscape scale surveys will be undertaken as per current best practice (Ref 8.32).

Water vole

8.9.157 The population of water vole within the study area (throughout the River Avon and within the southern reaches of the River Till) is considered to be of County Importance/ Medium Value.

8.9.158 The presence of water vole was identified within the River Avon, across the full extent of the study area and also within the lower reaches of the River Till (Appendix 8.22). As no construction activities are planned along the banks of the River Avon, it is unlikely that the proposed works would result in the damage or destruction of any burrows or the harm of any individuals. The proposed construction activities associated with the River Till viaduct will be restricted to the River Till floodplain and would not impact the banks of the River Till.

8.9.159 The potential impacts of construction would be:

a) habitat degradation; and

b) disturbance from noise, vibration, and lights.

8.9.160 **Habitat degradation:** As detailed within the River Avon SAC section the potential risk to the River Till from pollution during construction is anticipated to be somewhat greater than for the River Avon. This is because the crossing of the River Avon involves surfacing work and maintenance works on the existing bridge, whereas the River Till involves the construction of a new viaduct, although there are likely to be works on existing embankments near the bridge (although outside of the SAC). Pollution prevention measures included in the OEMP would avoid any pollution impacts associated with the construction phase.

8.9.161 **Disturbance:** Due to the distance of the Scheme from suitable water vole habitat (over 500m), construction activities within the River Till valley would not disturb water vole present within the downstream reaches. No construction activities are planned near to the River Avon. The slight increase in noise, vibration and light levels during the resurfacing over the River Avon bridge is unlikely to result in disturbance, as the local population is likely to be habituated to the levels of noise, vibration and light associated with traffic on the existing A303.

8.9.162 The implementation of the outlined mitigation would avoid any negative impacts. As such, the effects are neutral and not significant.

Otter

8.9.163 The population of otter within the study area (throughout the River Avon and within the southern reaches of the River Till) is considered to be of County Importance/ Medium Value.

8.9.164 The presence of otter was identified within all of the River Avon section located within the study area, and the lower reaches of the River Till (Figure 8.17). One intermittently used otter resting place was identified on the River Avon, approximately 50m from the Scheme boundary. As no construction activities are planned along the banks of the River Avon, it is unlikely that proposed works would result in the direct damage or destruction of this resting place or the harm of any individuals.

8.9.165 The habitats within the River Till floodplain (to the north of Winterbourne Stoke) are not considered suitable to support otter resting places, as they lack the suitable features required to provide shelter. As such, the construction activities within the River Till floodplain are unlikely to result in disturbance or damage to an otter resting place.

8.9.166 The potential impacts of construction would be:

a) disturbance of otter resting places and commuting routes;

b) habitat fragmentation; and

c) habitat degradation, relating to possible pollution of the watercourse.

8.9.167 **Disturbance:** Two possible otter resting places were identified within 20m of the Scheme boundary at Countess Roundabout (Figure 8.17) and one intermittently used resting place was identified approximately 50m from the Scheme boundary. It is likely that if otters are present, they would be habituated to the fairly high levels of light, noise and vibration associated with Countess Roundabout. Working measures detailed in the OEMP would reduce the likely disturbance impacts to acceptable levels for the adjacent residential properties. If otters are found to be present, measures to avoid disturbance would be incorporated into a Natural England European Protected Species licence. It is considered unlikely that otter would be adversely affected during construction.

8.9.168 **Habitat fragmentation:** It is possible that otters are using the River Till for commuting purposes, albeit probably only seasonally. The construction of the Scheme may cause disturbance to dispersing otters which may prevent them from accessing suitable habitat. The design of the construction activities around the River Till would avoid obstruction of the River Till corridor; as such, fragmentation impacts would be avoided.

8.9.169 **Habitat degradation:** Accidental pollution events during construction may cause long-term impacts to the vulnerable aquatic habitats present where the Scheme crosses the River Till and the River Avon. This may result in a change in the vegetation communities present, possibly resulting in the reduction of

prey and the degradation of suitable habitat. Pollution prevention measures included in the OEMP would avoid any pollution impacts associated with the construction phase.

8.9.170 The inclusion of the mitigation outlined above would result in effects that are considered to be neutral and not significant

Badger

8.9.171 The population of badgers within the study area is considered to be of Site Importance/ Less than Low Value.

8.9.172 The potential impacts of construction would be:

a) habitat loss;

b) direct mortality;

c) disturbance; and

d) habitat fragmentation.

8.9.173 **Habitat loss**: No main setts will be lost as part of the Scheme. One main sett is located within the Scheme boundary although this is located outside the works area, where the Scheme goes into the tunnel and so would not be affected. A total of four subsidiary, 19 outlying badger setts and one annex are located within the Scheme boundary, and thus will be lost as part of the Scheme (Figure 8.12). All badger sett closures will be undertaken under a Natural England badger sett closure licence, as detailed in the OEMP.

8.9.174 **Direct mortality and disturbance**: Construction activities may result in the direct mortality of badgers or the indirect disturbance of badgers whilst occupying a sett. To avoid this, suitable working practices, as detailed within the OEMP will be implemented within proximity to retained setts to prevent injury or disturbance to badgers during construction. The retained setts will be monitored accordingly.

8.9.175 **Habitat fragmentation**: The Scheme will result in the fragmentation of foraging habitat. The provision of mammal tunnels along or close to known badger paths which cross the existing A303, the green bridges and the bored tunnel of about 3km are considered suitable to maintain connectivity between suitable habitats within territories. As such, fragmentation impacts would be avoided.

8.9.176 The inclusion of the mitigation outlined above would result in effects that are considered to be neutral and not significant

Operation

Designated Sites

Chilmark Quarries, Mottisfont Bats and Mell Valley SAC

8.9.177 No direct or indirect impacts are anticipated on the SACs from operation of the Scheme (Appendix 8.25). As such, the effects on the integrity of the SACs designated for bats within 30km of the Scheme are considered to be neutral and not significant.

River Avon SAC

8.9.178 No direct impacts are anticipated on the River Avon SAC from operation of the Scheme. There may be habitat degradation impacts during operation, as follows.

8.9.179 **Habitat degradation:** Air quality modelling (Chapter 5 Air Quality and described in Appendix 8.24) shows the localised changes in air quality from the Scheme would be neutral. There is potential for indirect impacts associated with pollution from incidents such as traffic collisions, this in turn may have an impact on the vegetation and faunal species for which the SAC was designated. The embedded mitigation measures set out in Chapter 11 (Road Drainage and the Water Environment) for managing surface water runoff from the road include provision of appropriate measures for treatment of surface water that are likely to improve the current standards.

8.9.180 The inclusion of the mitigation outlined in Chapter 11 (Road Drainage and the Water Environment) would result in effects that are considered to be neutral and not significant.

Salisbury Plain SAC

8.9.181 No direct impacts are anticipated on the Salisbury Plain SAC from operation of the Scheme. There may be habitat degradation impacts during operation, as follows.

8.9.182 **Habitat degradation**: The realignment of the A303 would take the road closer to the Salisbury Plain SAC at Parsonage Down. This would have the potential to result in localised increases in NOx deposition on the SAC, which would have the potential to change vegetation by encouraging growth of tall grasses at the expense of other plant species.

8.9.183 In relation to air quality impacts during operation, a detailed air quality and emissions assessment has been undertaken as part of the Scheme in accordance with DMRB Volume 11 Section 3 Part 1 (Ref 8.1). The air quality modelling detailed within Chapter 5 (Air Quality) forecasts that at 2026 (the opening year) the critical level for NOx would not be breached on any transect modelled for any SAC or SSSI, with or without the Scheme. It can therefore be concluded that the Scheme would not have an adverse effect on Salisbury Plain SAC either alone or in combination with other plans and projects. It is therefore

unnecessary to consider nitrogen deposition since the principal contribution of road traffic to nitrogen deposition is via NOx.

8.9.184 The assessment included a quantitative assessment of effects of changes in air quality on statutory designated sites from nitrogen deposition (assessing all statutory sites within 200m of the Scheme or which are within 200m of the affected road network). Full results are included in Chapter 5 (Air Quality) (see Table 5.8 and Appendix 5.3, and additional text on air quality at designated sites given in Appendix 8.24). No adverse effects are predicted on these sites as a result of air quality changes during operation.

Salisbury Plain SPA

8.9.185 No direct impacts are anticipated on the SPA during the operational phase. There may be disturbance impacts on stone curlew during operation, as follows.

8.9.186 **Disturbance:** The provision of the tunnel as part of the Scheme would facilitate future access by visitors and local residents into areas south of the existing A303 in the vicinity of the Normanton Down RSPB reserve and the surrounding areas which are known to support breeding stone curlew. The Scheme would provide easier access to byways 11 and 12 south of the A303. If there is an increase in use of the existing byways 11 and 12, this may result in greater disturbance of breeding stone curlew and an indirect adverse permanent effect on nesting success locally.

8.9.187 The disturbance effects are influenced by a range of factors, including type of human activity, timing, frequency of occurrence, topography (which influences line-of-sight distance to nests), habitat, period in the breeding season and the experience of individual birds. Disturbance effects have been found to be greatest from dog walkers, less from other pedestrians and least from vehicles (Ref 8.67). The existing byways are fenced for purpose of livestock management at the Normanton Down RSPB reserve, which is likely to discourage, unauthorised public access to sensitive areas on adjacent farmland. As such, the residual effects are likely to be neutral and not significant.

River Till and River Avon System SSSI

8.9.188 The potential impacts on the River Till SSSI have been described in the operation section on the River Avon SAC (paragraphs 8.9.178 – 180). No significant effects are expected on the structure and function of the SSSIs. Further operational impacts associated with otters are discussed in the otter operations impacts section below.

Parsonage Down SSSI/ NNR

8.9.189 Air quality modelling (Chapter 5 Air Quality) showed that there would be no habitat degradation on Parsonage Down SSSI/ NNR from NOx deposition (as described within Salisbury Plain SAC section, paragraphs 8.9.182 - 184). The creation of chalk grassland between Parsonage Down and the Scheme would provide a buffer zone between the A303 and Parsonage Down. This conversion to chalk grassland would remove an existing area from agricultural nitrogen

fertilisation and prevent runoff or leaching into Parsonage Down SSSI. It has been estimated that 0.3 kg of nitrogen is lost due to leaching or surface runoff, for every kilogram of nitrogen fertiliser or manure applied to a field (Ref 8.7). As such, the creation of the chalk grassland would prevent further runoff into the SAC from the areas. Because air quality monitoring has shown no adverse effect on Salisbury Plain SAC at Parsonage Down SSSI, removing indirect effects of arable production, would be beneficial, but is not required to mitigate air quality effects. The main purpose of the provision of new chalk grassland at that location is for ecological network connectivity between the site and the Scheme.

Yarnbury Castle SSSI

8.9.190 No direct impacts are anticipated on the Yarnbury Castle SSSI from operational phase of the Scheme. There may be habitat degradation impacts during operation, as follows.

8.9.191 **Habitat degradation:** Yarnbury Castle SSSI is approximately 60m west of the Scheme boundary, near an existing section of the A303 dual carriageway. The air quality modelling (Chapter 5 Air Quality) has shown that the operational phase of the Scheme would result in an increase in NOx concentrations compared to the year of opening without the Scheme, but the difference is imperceptible (i.e. is below 0.4 μgm^{-3}) and total NOx concentrations would remain well below the critical level. As such, effects associated with air quality during the operational phase are considered to have a neutral and not significant effect on the SSSI and mitigation is not expected to be required.

Steeple Langford Down SSSI

8.9.192 No direct or indirect impacts on Steeple Langford Down SSSI are anticipated during the operational phase, as the site is located approximately 700m from the Scheme. No mitigation is expected to be required.

Non-statutory designated sites

8.9.193 The main potential for impacts would be changes to environmental conditions in the air as a result of dust during construction and nitrogen oxide and nitrogen deposition during operation, as well as water quality. As stated above, all sites located over 200m of the live carriageway are unlikely to result in adverse effects of NOx deposition (Chapter 5 Air Quality).

8.9.194 The potential impacts of the operational phase on non-statutory designated sites would be:

a) habitat degradation or improvement; and

b) disturbance of stone curlew.

8.9.195 **Habitat degradation:** The air quality and emissions modelling has forecast that the annual NOx concentrations would remain below the critical level of 30 μgm^{-3} throughout all the designated sites, or would have fallen below it by 2026. As such, the effects are considered to be neutral and not significant.

8.9.196 **Habitat improvement:** The diversion of the current A303 into a bored tunnel approximately 3km long is likely to result in a beneficial impact resulting from reduction of NOx deposition on Luxenborough Banks CWS, Stonehenge Down CWS and Normanton Down RSPB Reserve. These effects are considered to be neutral – slight beneficial and not significant.

8.9.197 **Disturbance:** The potential disturbance impacts on breeding stone curlews at Normanton Down RSPB Reserve associated with increased visitor levels are described above within the SPA operational impacts (Salisbury Plain SPA section, paragraphs 8.9.186 - 188).

8.9.198 The residual effects are considered to be neutral and not significant.

Habitats

8.9.199 There may be habitat degradation impacts during operation, as follows.

8.9.200 **Habitat degradation:** There is potential for indirect impacts associated with pollution from incidents such as traffic collisions. The embedded mitigation measures set out in Chapter 11 (Road Drainage and the Water Environment) for managing surface water runoff from the road include provision of appropriate measures for treatment of surface water to mitigate pollution to notably higher standards than at present.

8.9.201 The inclusion of the mitigation outlined in Chapter 11 (Road Drainage and the Water Environment) would result in effects that are considered to be neutral and not significant.

8.9.202 The potential for impacts on species from the operation of the Scheme includes:

a) habitat degradation or improvement, from increase or decrease in deposition of NOx from traffic emissions, or light spill from traffic at night;

b) disturbance, from traffic noise, or from changes in recreational use of public rights of way;

c) direct mortality, from collision with traffic.

Lichen

8.9.203 No direct impacts are anticipated on the lichen communities from the operational phase of the Scheme. There may be habitat improvement impacts during operation, as follows.

8.9.204 Habitat improvement: The diversion of the current A303 traffic into a tunnel is likely to result in a beneficial impact resulting from reduction of NOx deposition on the stones at Stonehenge, although the majority of the eutrophication on the stones is most likely to originate from perching birds (Ref 8.69).

8.9.205 This is likely to result in a neutral-slight beneficial effect at local level on the assemblage of lichens at Stonehenge. This effect would not be significant.

Aquatic species

8.9.206 The following species/ species groups all exist in the same ecological habitat, with the same potential impacts associated with the Scheme. As such, they have been grouped together. Species/ species groups that have been grouped were aquatic macro-invertebrates, Desmoulin's whorl snail, and fish.

8.9.207 No direct impacts are anticipated on aquatic species from operational phase of the Scheme. There may be habitat degradation impacts during operation, as follows.

8.9.208 **Habitat degradation:** There is potential for indirect impacts associated with pollution from incidents such as traffic collisions. The embedded mitigation measures set out in Chapter 11 (Road Drainage and the Water Environment) for managing surface water runoff from the road includes provision of appropriate measures for treatment to mitigate pollution to higher standards than at present. The residual effects are considered to be neutral and not significant.

Terrestrial invertebrates

8.9.209 No further impacts on terrestrial invertebrates associated with the operational phase are considered likely.

Amphibians and reptiles

8.9.210 No further impacts on amphibians and reptiles associated with the operational phase are considered likely.

Birds (breeding and wintering birds)

8.9.211 The potential impacts of the operational phase would be:

a) direct mortality; and

b) habitat degradation

8.9.212 **Direct mortality:** Certain species such as thrush and game birds are at a higher risk of collision as they fly at low heights. Collisions occur where hedgerows and other woodland habitat directly adjoins the carriageway. The embedded landscaping includes steep embankments, drainage verge along the verges rather than vegetation, thereby reducing the risk of direct mortality.

8.9.213 **Habitat degradation:** The Scheme once operational will result in likely limited increased noise levels specifically in the western section, compared to the current baseline. As described in Chapter 9 (Noise and Vibration) and Figure 9.4, the proximity of the Winterbourne Stoke bypass to the southeast corner of the SSSI results up to 2% of the SSSI experiencing a moderate increase, above the onset of effects threshold, with the Scheme in operation. The study area already contains a busy road, and the breeding bird survey (Appendix 8.15) shows that birds nest within 200m of the A303, including farmland species such as skylark and corn bunting. Hence changes in breeding bird territories due to traffic noise are likely to be minimal and populations are not likely to be affected.

The movement of traffic within the tunnel would not disturb birds at the surface. Instead conditions for approximately 3km would be quieter than at present, which would be beneficial for song birds, but not significant.

8.9.214 The residual effects of operation on birds are considered to be neutral and not significant.

Barn owl

8.9.215 The potential impact of the operational phase would be direct mortality associated with vehicle collision, as follows.

8.9.216 **Direct mortality:** Barn owls are vulnerable to direct mortality by road traffic collisions (Ref 8.65) this is an increased risk of barn owl collision particularly where the road is at grade or on an embankment and where a new high speed road severs existing foraging areas. This risk is especially relevant in the western section of the Scheme, where there is a cluster of historically active nesting sites (Figure 8.10).

8.9.217 To avoid the direct mortality of barn owls, the Scheme includes provisions to encourage barn owls to pass safely over the road, comprising false cuttings and planting where the highway is on embankment and four green bridges. A thick hedgerow or other planting of shrubs and trees would be incorporated in key locations, such as west of the River Till viaduct where hedges are severed. Cuttings and false cuttings would provide height prior to the establishment of vegetation (Figure 2.5). To avoid funnelling barn owls towards the highway verges, detailed design of landscaping on cuttings would include gaps in shrub and tree-planting where appropriate, to help direct owls that fly parallel to the highway away from the carriageway.

8.9.218 The inclusion of the River Till viaduct will not restrict barn owls from foraging within the optimal habitat recorded in the valley because the height of the twin deck bridge will be about 10m above the valley and it would be vegetated beneath the bridge, enabling hunting owls to fly along the grassland of the valley.

8.9.219 Barn owl road mortality records are clustered along the stretch of the existing A303 between Stonehenge and Normanton Down RSPB Reserve within the WHS (Figure 8.10). The conversion of the existing A303 to a restricted byway (within the WHS) will result in the permanent removal of the risk of direct mortality that is currently associated with the A303 traffic at this location. This will be a permanent beneficial effect.

8.9.220 The residual effects associated with the Scheme are considered to be beneficial at the local level, and not significant.

Stone curlew

8.9.221 Stone curlews are unlikely to be at risk from direct mortality as they are considered to be birds of open grassland and arable that tend to avoid steep terrains and hedgerows. As such, they are unlikely to access the soft estate

where they would be at risk from direct mortality with vehicles. There may be disturbance impacts during operation, as follows.

8.9.222 **Disturbance:** The potential disturbance impacts on breeding stone curlews at Normanton Down RSPB Reserve associated with increased visitor levels are described above within the SPA section (paragraphs 8.9.186 - 187).

Great Bustard

8.9.223 Great bustards are unlikely to be at risk from direct mortality as they are considered to be an open grassland plain species that tend to avoid steep terrains and hedgerows. As such, they are unlikely to access the soft estate or be at risk from direct mortality caused by vehicles.

8.9.224 The residual effects are considered to be neutral and not significant.

Bats

8.9.225 The potential impacts of the operational phase would be:

a) direct mortality; and

b) habitat degradation.

8.9.226 **Direct mortality:** Direct collision resulting in mortality of bats occurs in areas where bats would attempt to cross the highway when following existing or new linear features (hedgerows, tree lines, and other features). Vehicle collision resulting in direct mortality tends to be associated with the species adapted to edge habitat, such as pipistrelles, which are more likely to attempt to cross larger unsheltered and open spaces, at heights that may bring them into the path of oncoming vehicles. Studies have highlighted three mortality peaks during the year (Ref 8.66). Juvenile bats are considered to be more vulnerable to collision mortality; as such, the close proximity of any maternity roost may heighten the risk of collision.

8.9.227 Embedded mitigation includes the provision of false cuttings and associated planting where the Scheme is on embankment (to be planted in as soon as possible before opening) to provide suitable cover to help raise bat flight paths above the level of traffic. This provision is made along both sides of the Scheme from the green bridge at Parsonage Down east to where the Scheme is in cutting near the Till valley. Structural planting on both sides of the Scheme would help guide bats towards safe crossing points, where the risk of collision is reduced; these provisions include:

a) Green Bridge One, which includes bunds connecting to woodland on both sides;

b) Green Bridge Two , which includes bunds connecting to the hedge and scrub along the byway;

c) B3083 underbridge which includes bunds across the bridge on the north and south sides of the A303, as well as allowing passage under the A303;

d) Green Bridge Three, which includes planted bunds, although is separated by A360 slip roads and so is not directly connected;

e) Green Bridge Four, a green bridge over a deep cutting, albeit without bunds or scrub planting;

f) A section of existing A303 in the WHS converted to restricted byway, which removes the current risk to bats; and

g) A303 traffic diverted out of Winterbourne Stoke, where there are several bat roosts nearby.

8.9.228 The mitigation measures incorporated into the Scheme are considered suitable to maintain a permeable landscape for foraging and commuting bats in the wider landscape. As such, the effects are considered to be neutral. Monitoring surveys as set out in Section 8.8 would be carried out to verify crossings by bats and use of the landscape. The monitoring aims to replicate the surveys undertaken pre and during construction with additional surveys to assess the effectiveness of the mitigation features.

8.9.229 **Habitat degradation:** Increased light levels associated with the live traffic in the western section of the Scheme may deter bats (such as brown long-eared bats and *Myotis* species). It is possible that increased light and noise levels would affect foraging bats, specifically the species that use passive listening as a foraging technique. However, the measures incorporated into the Scheme such as cuttings, and planting regime are considered to mitigate the impacts associated with increased light spill from vehicle lights onto surrounding habitat where the Scheme is not in tunnel and therefore the effects are considered to be neutral.

Water Vole

8.9.230 No direct or indirect impacts are anticipated on water voles from the operational phase of the Scheme.

Otter

8.9.231 The potential impacts of the operational phase would be limited to direct mortality.

8.9.232 **Direct mortality:** A total of two otter road casualties have been recorded along the existing A303 near to the River Avon. The inclusion of Countess flyover has the potential to trap individuals on the slip roads. To avoid the impacts of direct mortality the culverts located near to the River Avon will be retained and otter fencing will be installed for up to 300m either side of the River Avon to guide individuals to safe crossing locations (Figure 2.3). The Scheme is not considered likely to result in an increase in mortality risk that would have an

adverse effect on the otter population; as such, the effect is considered to be neutral and not significant.

Badger

8.9.233 There may be direct mortality impacts during operation, as follows.

8.9.234 **Direct mortality:** Road casualties have been recorded along the existing A303, throughout the study area. The inclusion of green bridges and mammal tunnels would reduce the likelihood of badgers accessing the road verge and the reduce risk of vehicle collision.

8.9.235 The effects on badgers are considered to be neutral and not significant.

Ecosystems

8.9.236 An ecosystem is a dynamic complex of plant, animal and micro-organism communities (biotic) and their non-living (abiotic) environment interacting as a functional unit. Based on the likely residual effects associated with the key biotic (important biodiversity features) from the direct and indirect impacts associated with both the construction and operational phases, the Scheme is unlikely to result in an adverse impact on the integrity or function of any of the local ecosystems.

8.9.237 The Scheme would result in approximately 186ha of semi-natural habitats in the soft estate and the area east of Parsonage Down, mainly chalk grassland. Over time, this would contribute to enhancing the natural environment locally by providing net gains for biodiversity, and by establishing coherent ecological networks that are more resilient to current and future pressures.

8.9.238 Creating extensive calcareous grassland; improving connectivity of calcareous grassland and scrub communities, by direct connection and provision of stepping stones of habitat between Yarnbury Castle and Countess Junction, and buffering part of a SSSI/SAC site from arable production are likely to all have a beneficial effect on the integrity and function of the chalk downland ecosystem. The benefits would be limited at year of opening, due to the early stage of development of habitats, but are expected to increase annually by the assessment year (15 years after opening) and beyond under appropriate management. In this way the Scheme would contribute to providing net gains for biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures. Further monitoring surveys post construction of both the newly created habitats and suitable indicator species as set out within Section 8.8 would be undertaken to inform the development of the ecological network and assess the impact of the scheme at a landscape scale.

Summary of the assessment of effects

8.9.239 In summary it is considered that the only significant biodiversity adverse effect would be the permanent loss of the Countess Cutting CWS. The loss of 0.7ha of chalk grassland within this site at the year of opening would represent a moderate adverse residual effect. This loss would be compensated over time by

the creation of chalk grassland in the new cutting between the eastern portal and Countess Junction. The loss of the chalk grassland at Countess Cutting CWS would also represent a slight adverse residual effect on terrestrial invertebrates due to habitat loss. This impact would be partially mitigated by the provision of suitable mosaic habitat that is to be created for reptiles adjacent to the area to be lost and the new cutting mentioned above and is expected to be suitable for notable terrestrial invertebrates.

8.9.240 No further significant effects are anticipated. A summary of non-significant effects is provided in Appendix 8.23.

8.9.241 As shown on the Environmental Masterplan (Figure 2.5), there would be approximately 203ha of new habitats, mainly chalk grassland (162ha), which would be present and developing at year of opening (2026). By year 15 the establishment of this chalk grassland would represent a significant beneficial effect. The chalk grassland of the Scheme would enhance the west east connectivity, improving the ecological network along the whole length from Yarnbury Castle to Amesbury. Overall, there would be a net gain of approximately 186ha of semi-natural habitats. This, in conjunction with the provision of four green bridges, would represent a significant beneficial effect in terms of ecological network connectivity.

8.10 Monitoring

8.10.1 Monitoring is only proposed where it is necessary to manage residual effects on biodiversity features of importance. The Scheme would have a significant adverse effect on Countess Cutting CWS through its permanent loss. However, following completion of site clearance, there would be no on-going residual effects that would need to be monitored. As other effects have not been assessed as significant, monitoring is not necessary.

References

Ref 8.1: Highways Agency (2007) *Design Manual for Roads and Bridges: Volume 11.* Available from: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/index.htm [Accessed 21st August 2018].

Ref 8.2: Highway Agency (2010) *Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment.* Available from: http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian130.pdf [Accessed 21st August 2018].

Ref 8.3: Defra (2018) *A Green Future: Our 25 Year Plan to Improve the Environment.* Available from: https://www.gov.uk/government/publications/25-year-environment-plan [Accessed 21st August 2018].

Ref 8.4: Chartered Institute of Ecology and Environmental Management (CIEEM) (2016) *Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal,* 2nd edition. CIEEM, Winchester

Ref 8.5: Highways Agency (2005) *Design Manual for Roads and Bridges Volume 10 Section 4*. Available from: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol10/section4.htm [Accessed 21st August 2018].

Ref 8.6: Highways England (2017) *A303 Stonehenge – Amesbury to Berwick Down: EIA Scoping Report.* Highways England

Ref 8.7: Natural England (2006) *Natural Environment and Rural Communities (NERC) Act 2006.* The Stationery Office Limited. Available from: http://www.legislation.gov.uk/ukpga/2006/16/pdfs/ukpga_20060016_en.pdf [Accessed 21st August 2018].

Ref 8.8: British Lichen Society (2006) *Surveying and Report Writing for Lichenologists* (D.J. Hill, ed). British Lichen Society, London.

Ref 8.9: Joint Nature Conservation Committee (2010) *Handbook for Phase 1 habitat survey – a technique for environmental audit*. ISBN 0 86139 636 7. Available from: http://jncc.defra.gov.uk/page-2468#download [Accessed 21st August 2018].

Ref 8.10: Rodwell, J.S. (2006) *National Vegetation Classification Users' handbook.* Joint Nature Conservation Committee, Peterborough.

Ref 8.11: Hall, J.E., Kirby, K.J., and Whitbread A.M. (2004) (revised). *National Vegetation Classification: Field Guide to Woodland*. Joint Nature Conservation Committee.

Ref 8.12: Byfield A. and Wilson P. (2005) *Important Arable Plant Areas: Identifying priority sites for arable plant conservation in the United Kingdom*. Plantlife, Salisbury.

Ref 8.13: Defra (2007) *Hedgerow Survey Handbook.* 2nd Edition. Department of Food and Rural Affairs, London

Ref 8.14: Environment Agency (2003) *River Habitat Survey in Britain and Ireland.* Field Survey Guidance Manual: 2003. Bristol.

Ref 8.15: Life in UK Rivers (2003) *Monitoring Watercourses Characterised by Ranunculion fluitantis and Callitricho-Batrachion Vegetation Communities.* Conserving Natura 2000 Rivers Monitoring Series No. 11, English Nature, Peterborough.

Ref 8.16: UKTAG (2014) *Guide to Macrophytes in Rivers River LEAFPACS2*. Available at: http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Method%20Statements/River%20Macrophytes%20UKTAG%20Method%20Statement.pdf [Accessed 21st August 2018].

Ref 8.17: Killeen, I.J. and Moorkens, E.A. (2003) *Monitoring Desmoulin's whorl snail, Vertigo moulinsiana.* Conserving Natura 2000 Rivers Monitoring Series No. 6. English Nature, Peterborough

Ref 8.18: EU Star UK (2006) *RIVPACS Macroinvertebrate Sampling Protocol*. Available at: http://www.eu-star.at/pdf/RivpacsMacroinvertebrateSamplingProtocol.pdf. [Accessed 21st August 2018].

Ref 8.19: Peay, S. (2003).*Monitoring the white-clawed crayfish Austropotamobius pallipes*. Conserving Natura 2000 Rivers Monitoring Series No.1. English Nature, Peterborough.

Ref 8.20: Drake, C.M., Lott, D.A., Alexander, K.N.A. and Webb, J. (2007) *Surveying terrestrial and freshwater invertebrates for conservation evaluation*. 1st Edition. Natural England: Peterborough.

Ref 8.21: Environment Agency (2001) *Electric Fishing Code of Practice. Reference No. EAS/6100/4/02*

Ref 8.22: CEN (2003) *Water quality – sampling of fish with electricity. European standard –EN 14011:2003. Brussels: European Committee for Standardization,* 18 pp. Environment Agency (1999) Procedures for Collecting and Analysis Macroinvertebrate Samples (issue 2.0), Environment Agency BT001.

Ref 8.23: Harvey, J.P. and Cowx, I.G. (2003*). Monitoring the River, Brook and Sea Lamprey*. Conserving Natura 2000 Rivers Monitoring Series No. 5, English Nature, Peterborough, pp. 35

Ref 8.24: Amphibian and Reptile Groups of the United Kingdom (2010) *ARG UK Advice Note 5, Great Crested Newt Habitat Suitability Index*, ARG UK

Ref 8.25: Biggs *et al*., (2014) *Technical Advice Note for Field and Laboratory Sampling of Great Crested Newt eDNA in Analytical and methodological development for improved surveillance of the Great Crested Newt.* Defra Project WC1067

Ref 8.26: English Nature. (2001) *Great Crested Newt Mitigation Guidelines*. English Nature.

Ref 8.27: Gilbert, G., Gibbons, D.W., and Evans, J. (1998) *Bird Monitoring Methods—a manual of techniques for key UK species*. RSPB, Sandy.

Ref 8.28: Highways England (2016) *A303 Amesbury to Berwick Down - Ecology Surveys Method Statement HE551506*: Natural England Response.

Ref 8.29: Highways England (2005) *Mitigating Against Effects on Badgers: Badger Surveys. Design Manual for Roads and Bridges*, *Volume 10, Section 4, Part 2 HA 59/92,* Highways England

Ref 8.30: Collins, J. (ed.) (2016) *Bat Surveys for Professional Ecologists: Good Practice Guidelines* (3rd edn). The Bat Conservation Trust, London. ISBN-13978-1-872745-96-1

Ref 8.31: Mitchell-Jones, A.J. (2004). *Bat Mitigation Guidelines.* English Nature. ISBN-1-85716-781-3

Ref 8.32: Altringham, J. and Berthinussen (2015) *WC1060 Development of a cost-effective method for monitoring the effectiveness of mitigation for bats crossing linear transport infrastructure*. School of Biology, University of Leeds, Leeds

Ref 8.33: Mitchell-Jones, A.J, and McLeish, A.P. Ed., (2004) (3rd edn) Bat Workers' Manual. Joint Nature Conservation Committee ISBN-1-86107-55-8

Ref 8.34: Kunz (1988) *Ecological and Behavioural Methods for the Study of Bats*. Chapter 1: Capture Methods and Holding Devices.

Ref 8.35: Dietz, C. and Keifer, A. (2016) *Bats of Britain and Europe*. Bloomsbury Natural History

Ref 8.36: Bright, P., Morris, P. and Mitchell-Jones, T. (2006) *The dormouse conservation handbook-second edition*. English Nature

Ref 8.37: Dean, M., *et al.* (2016) *The Water Vole Mitigation Handbook* (The Mammal Society Mitigation Guidance Series). eds Mathews, F. and Chanin, P. The Mammal Society, London.

Ref 8.38: Chanin, P., 2003. *Monitoring the Otter, Lutra lutra*. Conserving Natura 2000 Rivers Monitoring.

Ref 8.39: Wiltshire Wildlife Trust (2012) *Wiltshire and Swindon Wildlife Sites Handbook. Wiltshire and Swindon Wildlife Sites Project.* Wiltshire Wildlife Trust.

Ref 8.40: Powell, M. and Shipway, P. (2017) *Lichens at Avebury*. Unpublished.

Ref 8.41: Macadam, C.R. (2016) *A review of the status of the mayflies (Ephemeroptera) of Great Britain - Species Status No.28.* Natural England Commissioned Reports, Number 193.

Ref 8.42: Willing, M. J. (2015) *Improvement Programme for England's Natura 2000 Sites (IPENS) – Planning for the Future IPENS061c SAC Status reporting on Vertigo moulinsiana in England: Monitoring at selected sites on the Hampshire / Wiltshire River Avon and tributary rivers Wylye and Bourne River Avon Special Area of Conservation (SAC).* Natural England

Ref 8.43: Highways England (2004) *A303 Stonehenge Improvement Environmental Statement, Chapter 7 Nature Conservation and Biodiversity.* Highways England

Ref 8.44: Froglife (1999) *Froglife Advice Sheet 10: reptile survey*. Froglife, London.

Ref 8.45: Harris, G., Harding, Hordley, G., and Sawyer, M. (2018) *The Herpetofauna of Wiltshire*. Wiltshire & Swindon Biological Records Centre and Wiltshire Amphibian & Reptile Group.

Ref 8.46: Baker, J., Suckling, J. and Carey, R. (2004) *Status of the adder Vipera berus and slow-worm Anguis fragilis in England.* English Nature. Research Report 546.

Ref 8.47: UKBAP (2010) *UK priority species: Zootoca vivipara* (version 2). Available from: http://jncc.defra.gov.uk/_speciespages/2356.pdf [Accessed 21st August 2018].

Ref 8.48: Massimino, D. *et al.* (2017) *Bird Trends 2017: trends in numbers, breeding success and survival for UK breeding birds.* BTO, Thetford. Research Report 704.

Ref 8.49: Wiltshire Ornithological Society (2018) *Atlas species records, Barn Owl, Summer abundance* Available from: http://www.wiltshirebirds.co.uk/atlas/abunchange/3_4/BO/0.html?_sm_au_=iVVTJw6DZH3rMvrQ [Accessed 21st August 2018].

Ref 8.50: RSPB (undated) *Stone-curlew, Population trends.* Available from: https://www.rspb.org.uk/birds-and-wildlife/wildlife-guides/bird-a-z/stone-curlew/population-trends [Accessed 21st August 2018].

Ref 8.51: BirdLife International. (2017). *Otis tarda. The IUCN Red List of Threatened Species 2017*: e.T22691900A119044104. Available from: http://dx.doi.org/10.2305/IUCN.UK.2017-3.RLTS.T22691900A119044104.en. [Accessed 21st August 2018].

Ref 8.52: Wiltshire Biodiversity Partnership (2008) *Wiltshire Biodiversity Action Plan 2008*. Wiltshire Wildlife Trust

Ref 8.53: Harris, G. and Linham, P. (2017). *Mammals in Wiltshire*. (2nd edn). Wiltshire & Swindon Biological Records Centre, Wiltshire Mammal Group & Wiltshire Bat Group.

Ref 8.54: Piraccini, R. (2016). *Barbastella barbastellus. The IUCN Red List of Threatened Species 2016:* e.T2553A22029285. Available from: http://dx.doi.org/10.2305/IUCN.UK.2016-2.RLTS.T2553A22029285.en. [Accessed 21st August 2018].

Ref 8.55: Bat Conservation Trust (2017) *The National Bat Monitoring Programme. Annual Report 2017*. Bat Conservation Trust, London. Available at http://www.bats.org.uk/pages/nbmp_annual_report.html [Accessed 21st August 2018].

Ref 8.56: Natural England (2013) *MAGIC website* Available from: http://www.magic.gov.uk/MagicMap.aspx [Accessed 21st August 2018].

Ref 8.57: Defra (2011) Biodiversity 2020: *A strategy for England's wildlife and ecosystem services.* Available from: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/69446/pb13583-biodiversity-strategy-2020-111111.pdf [Accessed 21st August 2018].

Ref 8.58: Natural England (2013) *The Mosaic Approach: Managing Habitats for Species (B2020-009).* Available from: http://publications.naturalengland.org.uk/publication/6415972705501184 [Accessed 21st August 2018].

Ref 8.59: Bat Conservation Trust (2009) *Bats and Lighting in the UK*, *Bats and the Built Environment Series.* Bat Conservation Trust. Available from: http://www.bats.org.uk/data/files/bats_and_lighting_in_the_uk__final_version_version_3_may_09.pdf [Accessed 21st August 2018].

Ref 8.60: Bat Conservation Trust (2014) *Interim guidance: Recommendations to help minimise the impact artificial lighting*. Bat Conservation Trust

Ref 8.61: Natural England (2000) *River Till SSSI citation* Available from: https://designatedsites.naturalengland.org.uk/PDFsForWeb/Citation/2000431.pdf [Accessed 21st August 2018].

Ref 8.62: Beebee T.J.C. and Griffiths R.A. (2000) *Amphibians and Reptiles,* London: Harper Collins. p 166–175.

Ref 8.63: Cresswell, W. and Whitworth, R. (2004) *An assessment of the efficiency of capture techniques and the value of different habitats for the great crested newt Triturus cristatus*. English Nature Research Reports, Number 575. English Nature, Peterborough.

Ref 8.64: Green, R.E., Tyler, G.A. and Bowden, C. G. R. (2000). *Habitat selection, ranging behaviour and diet of the stone curlew (Burhinus oedicnemus) in southern England*. Journal of Zoology, 250(02):161-183.

Ref 8.65: Shawyer, C. R. and Dixon, N. (1999). *Impact of Roads on Barn Owl Tyto alba Populations*. Highways Agency, London.

Ref 8.66: Barova, S. and Streit, A. (2016) *Action Plan for the Conservation of Bat Species in the European Union – 2016.* European Commission and Eurobats. Available from: *http://www.eurobats.org/sites/default/files/documents/pdf/Advisory_Committee/Inf%20EUROBATS%20AC21%205_0.pdf* [Accessed 21st August 2018].

Ref 8.67: Taylor, E. C. (2006) *Stone curlews Burhinus oedicnemus and human disturbance: effects on behaviour, distribution and breeding success*. PhD thesis. Darwin College, University of Cambridge.

Ref 8.68: Land Use Consultants for Natural England (2015) *Green Bridges: Technical Guidance Note 09/2015.* Landscape Institute

Ref 8.69: Coppins, B. and Powell, M. (2018) *Lichens at Stonehenge*. Unpublished

Ref 8.70: Duxbury, J.M., L.A. Harper, and A.R. Mosier. 1993. Contributions of agroecosystems to global climate change. In L.A. Harper, A.R. Mosier, J.M. Duxbury, and D.E. Rolston (eds.), *Agroecosystem Effects on Radioactively Important Trace Gases and Global Climate Change.* Spec. Pub. no. 55. ASA. Madison, WI. pp. 1-18.

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