

**M42 Junction 6 Improvement
Scheme Number TR010027
Volume 6
6.1 Environmental Statement
Chapter 9 – Biodiversity**

Regulation 5(2)(a)

Planning Act 2008

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

January 2019

Infrastructure Planning

Planning Act 2008

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

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**6.1 Environmental Statement
Chapter 9 Biodiversity**

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9 Biodiversity

9.1 Competent expert evidence

- 9.1.1 This chapter presents the results of an assessment of the likely significant effects of the Scheme on biodiversity, a process referred to as Ecological Impact Assessment (EclA).
- 9.1.2 The competent expert responsible for the assessment is an Associate within AECOM who holds the qualifications of BA (Hons) Applied Biology and MPhil (Nottingham University), and is a Full Member of the Chartered Institute for Ecology and Environmental Management (CIEEM).
- 9.1.3 They have 35 years of experience in ecological consultancy and contribute to, and manage, EclAs and projects relating to the protection and management of habitats and fauna, including nationally significant infrastructure projects. They possess a detailed knowledge EclA and species licencing, as applied to linear infrastructure, and have presented evidence at public inquiries.

9.2 Legislative and policy framework

- 9.2.1 The following legislation and planning policy is of direct relevance to the assessment of biodiversity, and summarises the detailed policy and legislative context presented within Appendix 9.15 [TR010027/APP/6.3] which has informed the assessment methodology.
- 9.2.2 Compliance with statute and policy relating to biodiversity is addressed within the Planning Statement [TR010027/APP/7.1].

The Conservation of Habitats and Species Regulations 2017

- 9.2.3 The Conservation of Habitats and Species Regulations 2017 [REF 9-1] (the Habitats Regulations) transpose the requirements of the EC Habitats Directive [REF 9-2] and Birds Directive [REF 9-3] into UK law, and provide for the designation and protection of European Sites (and adapt planning and other controls for the protection of these sites). This includes Annex I (including habitats) and Annex II (including species) for which such sites can be designated.
- 9.2.4 The Habitats Regulations [REF 9-1] also provide protection for certain European Protected Species (EPS) that are listed on Schedule 2 (plants) or Schedule 4 (animals). Provision is made for the granting of licences that permit certain acts as lawful, providing the appropriate authority is satisfied that there is no satisfactory alternative and the favourable conservation status of the species will be maintained.
- 9.2.5 The presence of European Sites (referred to as designated sites of international importance) and their relationship to the Scheme has been considered in the Habitats Regulations Assessment: No Significant Effects Report [TR010027/APP/6.8]. The presence of Annex I habitats and Annex II species, and also of any EPS, has been considered within the assessment.

Ramsar Convention

- 9.2.6 The Ramsar Convention 1971 [REF 9-4] provides international legislation for the designation of wetlands of international importance. Government policy extends the same level of protection to Ramsar wetlands as that afforded to sites that are designated under the Habitats Directive [REF 9-1].
- 9.2.7 Consideration has been given in the assessment to the presence of any Ramsar wetlands.

Wildlife and Countryside Act 1981

- 9.2.8 The Wildlife and Countryside Act 1981 [REF 9-5] (as amended) is a primary piece of UK wildlife legislation, protecting birds, other animals and plants (including vascular plants, bryophytes, lichens and fungi) and allowing for the designation of protected areas including Sites of Special Scientific Interest (SSSIs). The Act [REF 9-5] also defines a list of invasive non-native species, making it illegal to spread them in the wild.
- 9.2.9 Designated sites, protected flora and fauna and invasive species covered by the Act [REF 9-5] that will be affected by the Scheme have been considered in the assessment.

Countryside and Rights of Way Act 2000

- 9.2.10 The Countryside and Rights of Way Act 2000 [REF 9-6] extends powers relating to the protection and management of SSSIs. This includes powers for entering management agreements, placing a duty on public bodies to further the conservation and enhancement of SSSIs, increasing penalties for conviction, and appeal processes for the notification, management and protection of SSSIs. It also introduced the offence of 'reckless' disturbance of threatened species.
- 9.2.11 The legislative provisions relating to designated sites and flora and fauna affected by the Scheme have been considered in the assessment.

Natural Environment and Rural Communities Act 2006

- 9.2.12 Section 40 of the Natural Environment and Rural Communities Act 2006 [REF 9-7] (NERC Act) places a duty on public authorities in England to conserve biodiversity, which includes restoring or enhancing of a population or habitat.
- 9.2.13 Section 41 of the NERC Act [REF 9-7] requires the Secretary of State for Environment to publish and maintain a list of habitats and species that are of 'principal importance' for the purpose of conserving biodiversity, and are regarded as conservation priorities under the UK Post-2010 Biodiversity Framework [REF 9-8].
- 9.2.14 The occurrence of habitats and species of principal importance (SPI) has been identified in the assessment through a desk study and field surveys, and the design of the Scheme includes measures for their conservation and enhancement.

Protection of Badgers Act 1992

- 9.2.15 The Protection of Badgers Act 1992 [REF 9-9], provides specific legislation to protect badgers from cruelty.
- 9.2.16 The protection of badgers through best working practices, including the legal requirement for licences from Natural England (where required), has been considered as part of the assessment.

The Hedgerow Regulations 1997

- 9.2.17 The Hedgerow Regulations 1997 [REF 9-10] covers legislation for the protection of countryside hedgerows that are considered 'important' as they meet specific archaeological, wildlife or landscape criteria.
- 9.2.18 The assessment has evaluated hedgerows potentially affected by the Scheme by way of field survey, to determine whether any qualify as important under the criteria.

Salmon and Freshwater Fisheries Act 1975

- 9.2.19 The Salmon and Freshwater Fisheries Act 1975 [REF 9-11] (as amended) relates to the protection of freshwater fish, with a focus on salmon and trout species.
- 9.2.20 The assessment has considered the provisions of the Act [REF 9-11] in relation to the risk of morality, migration barriers, pollution and the degradation of habitats potentially resulting from the Scheme.

Animal Welfare Act 2006

- 9.2.21 The Animal Welfare Act 2006 [REF 9-12] protects vertebrate animals from harm, and extends to domesticated animals and those under the control of people.
- 9.2.22 The provisions of the Act [REF 9-12] have been taken account of within the assessment by ensuring the welfare of any animals potentially affected by the Scheme are considered.

Wild Mammals (Protection) Act 1996

- 9.2.23 The Wild Mammals (Protection) Act 1996 [REF 9-13] makes it an offence to harm wild mammals with intent to inflict unnecessary suffering.
- 9.2.24 The assessment has considered the requirements of the Act [REF 9-13], and includes measures to ensure any risk of unnecessary suffering of wild animals is avoided.

National Policy Statement for National Networks

- 9.2.25 The National Policy Statement for National Networks (NPSNN) [REF 9-14] sets out the matters that the Secretary of State for Transport should give due regard to when determining Development Consent Order (DCO) applications that will affect biodiversity and ecological conservation.
- 9.2.26 Within the NPSNN [REF 9-14], the requirements of paragraphs 4.22 and 4.25 in relation to identifying whether the Scheme would have a significant effect on the objectives of a European Site have been addressed within the Habitats Regulations Assessment: No Significant Effects Report [TR010027/APP/6.8].

- 9.2.27 The requirements of paragraphs 5.22, 5.26 and 5.32 to 5.35 in relation to the identification and assessment of the likely significant effects of the Scheme on sites of international, national and local importance, the conservation of biodiversity, and protected species and habitats have been addressed through the assessment process, and are reported within this chapter.
- 9.2.28 Paragraph 5.23 provides guidance on the principles that should be applied in relation to avoiding adverse impacts on sites, species and habitats (set out within paragraph 5.22), providing appropriate mitigation as an integral part of the Scheme, and taking advantage of conservation and enhancement opportunities. This guidance has informed the design-development process (see Chapter 4 Scheme history and alternatives) in relation to the identification and incorporation of ecological mitigation and enhancement measures within the design of the Scheme (see Chapter 3 The project).

National Planning Policy Framework

- 9.2.29 A core principle of the National Planning Policy Framework (NPPF) [REF 9-15] is that policies and decisions should contribute to, and enhance, the natural environment.
- 9.2.30 In relation to biodiversity, the NPPF [REF 9-15] contains similar provisions to the NPSNN [REF 9-14], although a key difference is the removal of references to *“avoiding net loss of biodiversity”* and the 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”*.
- 9.2.31 The assessment has taken account of the requirements of the NPPF [REF 9-15] by establishing the importance of ecological features through a desk study and field surveys, by implementing the mitigation hierarchy as an integral part of the Scheme design, and through identifying potential biodiversity gains.

National Planning Practice Guidance

- 9.2.32 The National Planning Practice Guidance for the Natural Environment [REF 9-16] provides context to the NPPF [REF 9-15] and advises on how the consideration of biodiversity can inform planning decisions.
- 9.2.33 The guidance has been considered by undertaking a desk study and field surveys to define important ecological features, evaluating how the Scheme may affect the status of these features with reference to conservation objectives, and by developing mitigation measures with relevant consultees.

Solihull Local Plan: Shaping a Sustainable Future

- 9.2.34 The adopted Solihull Local Plan: Shaping a Sustainable Future [REF 9-17] contains policies that seek to protect and enhance the natural environment.

9.2.35 Policy P10: Natural Environment identifies the need to conserve, enhance and restore biodiversity, and references objectives contained within other planning documents including Warwickshire, Coventry and Solihull's Biodiversity Action Plan (BAP) [REF 9-18] and the Green Infrastructure Study [REF 9-19]. The policy sets out measures for the protection of designated sites, ancient woodland and priority habitat and species, and also the enhancement of the natural environment.

9.2.36 These local policy requirements have been considered in the assessment through the identification of ecological features, designated sites, protected species, and priority habitats and species. The design-development process has sought to avoid significant harm to these features, and, where this was not possible, the mitigation hierarchy has been applied to maintain the conservation status of biodiversity features.

Natural England and Department for Environment, Food and Rural Affairs (DEFRA) Standing Advice (protected species)

9.2.37 Standing advice from Natural England and DEFRA [REF 9-20] provides guidance on protected and notable species, and including reference to the best practice approaches to surveying, mitigation and compensation. Guidance is also provided on the procedure for obtaining protected species licences.

9.2.38 This advice has informed the planning of surveys and the approach to mitigating impacts upon protected species, including where necessary the requirement for derogation licences.

UK Post-2010 Biodiversity Framework

9.2.39 The UK Post-2010 Biodiversity Framework [REF 9-8] illustrates how the work of the four UK countries joins up to achieve international and European biodiversity targets.

9.2.40 The objectives of this framework [REF 9-8] have been included in the assessment through consideration of the habitats and SPIs.

Biodiversity 2020, A strategy for England's wildlife and ecosystem services

9.2.41 Biodiversity 2020, A strategy for England's wildlife and ecosystem services [REF 9-21] sets out the strategic direction for biodiversity policy up to 2020.

9.2.42 In accordance with the objectives of the strategy [REF 9-21], the assessment includes consideration of ecological networks and measures to reduce pressure upon, and enhance, the environment.

Warwickshire, Coventry and Solihull Local Biodiversity Action Plan

9.2.43 The Warwickshire, Coventry and Solihull Local Biodiversity Action Plan (LBAP) [REF 9-18] provides action plans that define conservation objectives for local priority habitats and species, a number of which are of relevance to the Scheme:

- a. species – barn owl, bats, farmland birds, great crested newt (GCN), and hedgehog; and

- b. habitats – built environment, hedgerows, neutral grassland, ponds, rivers and streams, roadside verges, and woodland.

9.2.44 The assessment has taken account of the LBAP conservation objectives to evaluate effects upon relevant species and habitats, and also as a means to guide the targeted improvement of biodiversity.

Nature Conservation in Solihull

9.2.45 The Nature Conservation Strategy ‘Nature Conservation in Solihull’ (first reviewed February 2010) [REF 9-22] sets out strategic objectives for biodiversity conservation and provides guidance on how nature conservation is expected to be taken into account in the development control process.

9.2.46 The assessment has applied these strategic objectives by completing surveys to establish a robust baseline, by applying the mitigation hierarchy, and including ecological enhancements.

Solihull Green Infrastructure Study

9.2.47 The Coventry and Solihull Sub-Regional Green Infrastructure Strategy [REF 9-19] provides evidence for the preparation of plans, policies and strategies relating to Green Infrastructure at a sub-regional level.

9.2.48 The assessment has considered how the Scheme will contribute to the maintenance of coherent and resilient green infrastructure networks at a sub-regional level.

Highways England Road Investment Strategy

9.2.49 The Road Investment Strategy [REF 9-23] sets an aspiration that the operation, maintenance, and enhancement of the strategic road network should move to a position that delivers no net loss of biodiversity and, in the long term, should deliver a net gain in biodiversity.

9.2.50 The potential for the Scheme to deliver biodiversity gains has been considered as part of the design-development and assessment processes.

Highways England Biodiversity Plan 2015

9.2.51 The Highways England BAP [REF 9-24] sets out how the organisation will work with service providers to halt overall biodiversity loss, and to maintain and enhance habitats and ecological networks.

9.2.52 The objectives of this plan [REF 9-24] have been considered through the assessment of the Scheme’s effects upon biodiversity and by identifying enhancements within the design of the Scheme.

9.3 Assessment methodology

Scope of the assessment

9.3.1 A scoping exercise was undertaken in late 2017 to identify the matters to be covered by the biodiversity assessment and agree the approach with relevant statutory bodies.

- 9.3.2 The outcomes of the scoping exercise were recorded in a scoping report [REF 9-25], which was consulted upon as part of a formal request to the Planning Inspectorate (the Inspectorate) for a scoping opinion. The scoping report [REF 9-25] included a summary of all assessment work undertaken as part of the design-development of the Scheme up to the point of its publication.
- 9.3.3 The Inspectorate's scoping opinion [REF 9-26] identified a number of additional overarching EIA and topic-specific matters that were subsequently brought into the overall scope of the assessment. These further considerations are detailed in Appendix 5.3 [TR010027/APP/6.3] and include responses to the points raised, and identify where the relevant information is presented within this chapter and elsewhere in this Environmental Statement.
- 9.3.4 In addition to the matters raised in the scoping opinion [REF 9-26], the final assessment scope has also been shaped by the following:
- a. design changes made to the Scheme in respect of its form and extent, and the area of land required for its construction, operation and maintenance;
 - b. the outcomes of consultation with statutory bodies, non-statutory organisations and other stakeholders with an interest in ecology and nature conservation;
 - c. the outcomes of further desk-based studies undertaken to establish the baseline conditions associated with the ecological environment, and to inform the identification of the likely significant effects of the Scheme.
- 9.3.5 Consideration was given to the activities associated with the future maintenance and management of the Scheme, and whether these have the potential to result in significant effects in relation to biodiversity. Following a review of the maintenance activities presented in Chapter 3 The project, the process concluded that there will be limited potential of such effects to occur, and that these activities are comparable with standard maintenance operations already being undertaken elsewhere on the strategic and local road networks. Accordingly, the effects associated with this phase of the Scheme were scoped out of the assessment and are not considered further.
- 9.3.6 As part of the desk-based surveys and field surveys undertaken to establish the baseline ecological conditions (see Section 9.6), it was concluded that the following ecological features could be scoped out of the assessment on the basis that they are of negligible ecological importance:
- a. arable habitat;
 - b. improved grassland;
 - c. amenity grassland;
 - d. scattered trees;
 - e. ephemeral- short-perennial habitat;
 - f. ditches;
 - g. building and hardstanding;

h. polecat; and

i. reptiles

9.3.7 Ecological features that were confirmed to be absent within the adopted study areas (see Section 9.5) and therefore scoped out of the assessment comprised:

a. marshy grassland (outside boundary of designated sites);

b. hazel dormouse;

c. water vole; and

d. white-clawed crayfish.

9.3.8 Further details regarding these ecological features, and the justification for not considering them further in the assessment, are presented within Section 9.6.

9.3.9 The Scoping Report [REF 9-25] proposed a study area of 2km for the assessment of effects on non-statutory designated sites. Following a review of the characteristics of the Scheme and the extent of the Order Limits, it was concluded that only those sites located within 1km of the Order Limits would have the potential to be impacted by the Scheme. Accordingly, the scope of the assessment was altered to focus this on non-statutory designated sites within this distance.

9.3.10 Subsequent to receipt of the scoping opinion [REF 9-26], engagement was held with Natural England and the Environment Agency to inform the scoping of certain surveys and the development of mitigation measures, the full details of which are presented within Appendix 9.17 [TR010027/APP/6.3].

Assessment guidance

9.3.11 The following guidance has been used to inform the scope and content of the assessment, and to assist the identification and mitigation of likely significant effects. This builds upon the overarching EIA methodology and guidance presented in Chapter 5 EIA methodology and consultation.

Design Manual for Roads and Bridges: Volume 11

9.3.12 Guidance contained within Design Manual for Roads and Bridges (DMRB): Volume 11, Section 3, Part 4 – Ecology and Nature Conservation [REF 9-27] has been used to guide the approach to the assessment of impacts and effects on ecological features.

Design Manual for Roads and Bridges: Interim Advice Note 125/15

9.3.13 Scoping, assessment and reporting guidance contained within DMRB Interim Advice Note (IAN) 125/15: Environmental Assessment Update [REF 9-28] has been used in conjunction with DMRB Volume 11 [REF 9-27] to inform the assessment.

9.3.14 As scoping identified a likelihood of significant environmental effects resulting from the Scheme, a detailed assessment has been undertaken in line with this guidance.

Design Manual for Roads and Bridges: Interim Advice Note 130/10

- 9.3.15 Guidance and criteria relating to the characterisation of ecological impacts and the determination of the significance of effects on ecological features contained within DMRB IAN 130/10: Ecology and Nature Conservation – Criteria for Impact Assessment [REF 9-29] has been applied in the assessment.

Guidelines for Ecological Impact Assessment in the UK and Ireland

- 9.3.16 The Guidelines for Ecological Impact Assessment in the UK and Ireland [REF 9-30] (referred to as the 'CIEEM guidelines') have been referenced in the assessment to supplement the guidance and criteria applied from the DMRB [REF 9-27];[REF 9-28];[REF 9-29] in relation to:
- the identification of the assessment scope;
 - establishing the baseline conditions within defined study areas (referred to as zones of influence);
 - evaluating the importance of ecological features; and
 - the identification and assessment of impacts and effects, and their mitigation.

Establishment of the baseline conditions

- 9.3.17 Establishment of the baseline environment has involved reference to existing data sources, consultation with statutory bodies and other organisations, and fieldwork surveys.

Desk study

- 9.3.18 A desk study was undertaken to identify nature conservation designations, and protected and notable habitats and species (ecological features) potentially relevant to the Scheme, the scope of which was defined using a combination of published guidance [REF 9-27];[REF 9-29];[REF 9-30] and professional judgement.
- 9.3.19 Information and views concerning the Scheme were obtained from the following organisations:
- Natural England;
 - Environment Agency;
 - Warwickshire Wildlife Trust; and
 - Warwickshire Biological Records Centre.
- 9.3.20 Data sourced from these organisations as part of the desk study was used to develop and refine the information gathered as part of the scoping exercise [REF 9-25]. This was supplemented by information obtained from web-based resources, assessments published by third parties, and other data and records relating to the following ecological features:
- international, national and local statutory nature conservation sites, and non-statutory nature conservation sites;
 - protected and notable habitats and species; and

c. non-native controlled weed and animal species.

- 9.3.21 Relevant protected and notable habitats and species include those: listed under Schedules 1, 5 and 8 of the Wildlife and Countryside Act 1981 (as amended) [REF 9-5]; Schedules 2 and 5 of the Habitats Regulations [REF 9-1]; species and Habitats of Principal Importance (HPI) for nature conservation in England listed under Section 41 of the NERC Act [REF 9-7]; and other species that are Nationally Rare, Nationally Scarce or listed in national or local Red Data Lists and Biodiversity Action Plans.
- 9.3.22 Records of non-native controlled weed and animal species, as listed under Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) [REF 9-5], were collated and taken into account as, whilst they are not relevant ecological features within EclA, they: have potential relevance to achieving legislative compliance; can contribute to the amplification of any adverse effects from the Scheme; and have the potential to conflict with objectives for ecological mitigation, compensation and enhancement.
- 9.3.23 Other information sources referenced as part of the baseline review included 1:25,000 and 1:10,000 scale Ordnance Survey mapping, 3-dimensional topographical data, and aerial photography available in the public domain.
- 9.3.24 Engagement was also undertaken with Birmingham Airport to inform the development of the planting strategy, as described in the Consultation Report [TR010027/APP/5.1].
- 9.3.25 The full details of the information obtained as part of the desk study are presented within Appendix 9.1 [TR010027/APP/6.3].

Field surveys

- 9.3.26 Field surveys were undertaken by qualified and experienced ecologists throughout 2017 and 2018 (ending in October 2018), the purpose of which were to identify, record and map vegetation, habitats and protected species within the study areas defined in Section 9.5.
- 9.3.27 The scope of the following field surveys were established through the desk study and through consultation with Natural England and the Environment Agency:
- extended phase 1 habitat survey (including invasive plant species) and phase 2 habitat surveys – reported in Appendix 9.2 [TR010027/APP/6.3];
 - hedgerow survey – reported in Appendix 9.3 [TR010027/APP/6.3];
 - badger survey – reported in Appendix 9.4 [TR010027/APP/6.3] [CONFIDENTIAL];
 - bat survey – reported in Appendix 9.5 [TR010027/APP/6.3];
 - breeding bird survey – Appendix 9.6 [TR010027/APP/6.3];
 - barn owl – Appendix 9.6 [TR010027/APP/6.3];
 - wintering bird survey – reported in Appendix 9.7 [TR010027/APP/6.3];
 - hazel dormouse – reported in Appendix 9.8 [TR010027/APP/6.3];

- i. GCN – reported in Appendix 9.9 [TR010027/APP/6.3];
- j. reptile survey – reported in Appendix 9.10 [TR010027/APP/6.3];
- k. terrestrial invertebrates – reported in Appendix 9.11 [TR010027/APP/6.3];
- l. aquatic habitat appraisal – reported in Appendix 9.12 [TR010027/APP/6.3];
- m. white-clawed crayfish – reported in Appendix 9.13 [TR010027/APP/6.3]; and
- n. water vole – reported in Appendix 9.14 [TR010027/APP/6.3].

9.3.28 Surveys were undertaken in September 2018 by a suitably qualified and experienced arborist, to identify and map the location, age, species and health of all trees within the Scheme's Order Limits. The findings of these surveys are presented within Appendix 8.2 [TR010027/APP/6.3].

Importance (value) of ecological features

9.3.29 The importance (value) of ecological features (comprising designated sites, habitats, species assemblages and populations of species) has been assessed with reference to their:

- a. nature conservation status (which relates to rarity and threat status);
- b. conservation value (which relates to the need to conserve representative areas of different habitats and the genetic diversity of species populations); and
- c. legal status (i.e. whether they are afforded protection under legislation).

9.3.30 Other characteristics considered to contribute to the importance of ecological features include, but were not limited to:

- a. habitat diversity;
- b. whether the species population size is notable in a wider context;
- c. rich assemblages of plants and animals; and
- d. species on the edge of their range (particularly where their distribution is changing as a result of global trends and climate change).

9.3.31 Importance was determined based on the following geographical contexts:

- a. International and European;
- b. National (England);
- c. Regional (West Midlands);
- d. County (Warwickshire);
- e. Local (Solihull); and
- f. Negligible (at a Parish scale or smaller).

- 9.3.32 The importance of features does not necessarily equate directly to their sensitivity. For example, an ecological feature of high conservation importance may comprise a robust ecosystem which is resilient to effects caused by external factors, and is therefore not highly sensitive. Conversely, an ecological feature may be highly sensitive to change but widespread or abundant at the geographic scale considered and therefore the population within the study area may not be important at that scale.
- 9.3.33 The criteria applied in the assessment to determine importance are presented in **Table 9.1** and have been developed from the criteria contained within DMRB IAN 130/10 [REF 9-29], with additional criteria applied from the more recent CIEEM guidelines [REF 9-30] where appropriate.

Table 9.1: Criteria for assessing the importance of features

Importance	Criteria
International (European)	<p>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.</p> <p>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.</p>
National (England)	<p>Habitats: Designated sites including: SSSIs; Marine Protected Areas including Marine Conservation Zones; and National Nature Reserves. Areas which meet the published selection criteria for e.g. Joint Nature Conservation Committee selection criteria for SSSI (2013) [REF 9-31] for those sites listed above but which are not themselves designated as such. Areas of key/priority habitats identified in the UK BAP [REF 9-32], including those published in accordance with section 41 of the NERC Act [REF 9-7] and those considered to be of principal importance for the conservation of biodiversity (HPI). Areas of Ancient Woodland (e.g. woodland listed within the Ancient Woodland Inventory [REF 9-33]).</p> <p>Species: Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level (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 phase of its life cycle at this scale.</p>

Importance	Criteria
Regional (West Midlands)	<p>Habitats: Areas of key/priority habitats identified within BAPs produced within the region (where available); areas of key/priority habitat identified as being of Regional value in the appropriate Natural Area Profile [REF 9-34] (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats.</p> <p>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 region 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.</p>
County (Warwickshire)	<p>Habitats: Designated sites including: Local Wildlife Sites (LWSs); and Local Nature Reserves 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 [REF 9-34] (or equivalent).</p> <p>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.</p>
Local (Solihull)	<p>Habitats: Trees that are protected by Tree Preservation Orders. 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.</p> <p>Species: Populations/communities of species considered to appreciably enrich the biodiversity resource within the local context.</p>
Negligible (below Local)	<p>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.</p> <p>Species: Common or widespread species.</p>

9.3.34 Where a feature has value at more than one level of importance, its overriding value is that of the highest level.

9.3.35 The importance of ecological features identified within the assessment is evaluated and presented as part of the baseline conditions reported within in Section 9.6.

Magnitude of impact criteria

9.3.36 Impacts on ecological features resulting from the Scheme have been characterised by taking into consideration the following aspects, where applicable:

- a. positive (beneficial) or negative (adverse) impact;
- b. probability of occurring (certain, probable or unlikely);
- c. extent (area measures or percentage of total, such as area of habitat/territory lost);
- d. size or magnitude (description of severity of influence, for example a reduction of quality of habitat or complete loss);
- e. reversibility (reversible or not reversible);
- f. duration (permanent or temporary in ecological terms);
- g. timing and frequency (important seasonal or life-cycle constraints and any relationship with frequency considered); and
- h. complexity (direct, indirect, in-combination or cumulative).

9.3.37 In relation to the complexity of an impact:

- a. a direct impact is considered to be a direct consequence of the Scheme, or a particular activity, including physical loss or gain of a habitat, or direct mortality of individuals or populations;
- b. an indirect impact is considered to occur via an intermediary or as a result of an impact pathway, for example impacts on air quality or water leading to changes in habitats or the populations of species they support;
- c. the impacts arising from different activities can act in combination within the Scheme to affect habitats and species populations; and
- d. a cumulative impact can arise from the combination of several development projects acting simultaneously or in succession.

9.3.38 The magnitude of impact has been defined using the generic impact criteria and ratings presented in **Table 5.2** within Chapter 5 EIA methodology and consultation.

9.3.39 Impacts on biodiversity arising from construction and operation of the Scheme are reported separately. A further assessment is made, where relevant, in the design year (15 years after construction) to report the contribution that certain types of mitigation measure will have on these impacts once established and fulfilling their intended function, for example replacement hedgerows.

- 9.3.40 As the greatest impacts on ecological sites, habitats and species are generally attributed to those arising from construction, construction impacts and those associated with the long term presence of the Scheme are presented together as part of the construction phase impacts within the assessment. The purpose of this is to avoid repetition within the chapter, and to reflect the fact that ecological habitats are lost during site clearance activities and that any new habitats (for example those proposed as mitigation) will not have been established in the construction period.
- 9.3.41 Impacts arising from the operational phase are those associated with the operation and use of the Scheme, for example the impacts of vehicle lighting, noise and air pollution arising from traffic travelling on new or improved sections of road within the Scheme, and those associated with any road lighting incorporated into the design of the Scheme.
- 9.3.42 The identification of impacts on ecological features during either construction or operation takes account of the relevant embedded and standard mitigation measures, and compensation measures, described in Section 9.8.

Identification of likely significant effects

- 9.3.43 The identification of the likely significant effects on ecological features has involved combining the importance (value) of a given ecological feature with the predicted magnitude of impact, using professional judgement.
- 9.3.44 The process of identification has been guided by the CIEEM guidelines [REF 9-30], which state that: *“For the purpose of ecological impact assessment, a '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)”*.
- 9.3.45 Effects have been reported in relation to the geographic scale at which they may occur i.e. from International to below Local level, as summarised within **Table 9.1**.
- 9.3.46 The categories of significance applied in the assessment have been adapted from those presented in DMRB IAN 130/10 [REF 9-29], as follows:
- a. very large – these represent impacts on features of International, European, UK or National value (only adverse effects are assigned this level of significance as they are considered to represent key factors in the decision-making process);
 - b. large – these represent impacts on features of Regional value (these effects are considered to be very important considerations and are likely to be material to the decision-making process);
 - c. moderate – these represent impacts on features of County or Unitary Authority Area value (these effects are considered to be important in informing the decision-making process);

- d. slight – these represent impacts on features of Local value (these effects are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of a project); and
- e. neutral – these represent no significant impacts on key nature conservation features (these comprise effects that are absent or those which are beneath levels of perception).

9.3.47 In relation to these categories, a significant effect in relation to the EIA Regulations [REF 9-35] is one which is identified as being of moderate or greater significance (these being considerations that are either important, material or key factors in the decision-making process).

9.4 Assessment assumptions and limitations

Scheme design and limits of deviation

9.4.1 The assessment has been based on the Scheme description detailed within Chapter 3 The project, and has taken into account the lateral and vertical limits of deviation defined on the Works Plans [TR010027/APP/2.3] in order to establish a realistic worst case assessment scenario.

9.4.2 This scenario has identified and reported the effect that any lateral and vertical deviation would realistically give rise to. This has, for example, taken into account the potential for the Scheme to be brought into closer proximity to ecological features, and thereby potentially result in a different effect.

9.4.3 Notwithstanding any potential deviation, all biodiversity mitigation measures described in Section 9.8 will still be deliverable within the limits of deviation and will still fulfil their intended function.

Warwickshire Gaelic Athletic Association

9.4.4 Using professional judgement, the illustrative reconfiguration design options for the Warwickshire Gaelic Athletic Association (WGAA) presented on **Figure 3.5a to 3.5e** [TR010027/APP/6.2] have been appraised to take account of the variation in the physical extents, pitch layout, buildings, fencing and lighting provision across the options.

9.4.5 The objective of the appraisal was to identify whether one option would potentially give rise to different effects than another, in order to then identify the worst case for the purposes of the assessment presented within this chapter.

9.4.6 The appraisal concluded that the design variation between the options would not be of a level that would result in different types or significance of effect on ecological features.

Baseline survey data

9.4.7 The assessment has been based on, and is limited to, the baseline conditions recorded at the time of undertaking field surveys (noting seasonal variations).

9.4.8 In all cases, the use of third party data within this assessment has been supported by an appraisal of the likely current baseline conditions. This includes verification of the current extent and condition of habitats in order to evaluate any risk of change in the baseline ecological information, and therefore the validity of the third party data relied upon in the assessment. This is considered to be a proportionate and reasonable approach for evaluating any potential impacts, developing mitigation measures, and assessing the likelihood of significant effects.

Great crested newt

9.4.9 In relation to GCN surveys, any inaccessible ponds connected to the Order Limits by terrestrial habitat considered suitable for GCN have been assumed to support a medium GCN population (pond 19 only, see Section 9.6). This is considered to be a reasonable and proportionate assumption given the known population status of GCN in the surrounding area (small or medium populations).

9.4.10 All other inaccessible ponds were considered to be separated from Order Limits by barriers to the dispersal of GCN, such as roads, flowing water or generally unsuitable habitat (for example intensively managed arable or pasture). Therefore, any GCN that may be present in these ponds are unlikely to make use of the habitats within the Order Limits because any GCN will be unable to access them, and therefore do not represent a constraint.

9.4.11 On this basis, it is considered that limitations relating to access do not limit the scope of the assessment, which is sufficient to assess any likely significant effects and define appropriate mitigation.

Reptiles

9.4.12 Some areas of reptile-suitable habitat within the Order Limits were not accessible to survey. These comprised Hollywell Brook and an area of land south west of M42 Junction 6 (central grid reference SP 195 828).

9.4.13 At Hollywell Brook the habitat is confined to the bankside vegetation of this watercourse, and as such is likely to only be suitable for occasional use by grass snake, for example, for basking. On this basis, and as agreed with the Environment Agency (see Appendix 9.17 [TR010027/APP/6.3]), a precautionary approach was adopted in the assessment assuming that areas of suitable habitat will be used on no more than an occasional basis by grass snake. This assumption is considered sufficient to evaluate impacts and to inform the design of mitigation for this species.

9.4.14 For the land south west of M42 Junction 6, separate areas within the Order Limits that were connected to it by reptile-suitable habitat were surveyed. Reptiles were shown to be absent from these and all other areas surveyed, which is consistent with historical desk study records (see Section 9.6).

Faunal surveys

9.4.15 The desk study and ecological baseline data collected from faunal surveys presented within Section 9.6 is considered to be sufficient to provide a robust assessment of the likely significant effects of the Scheme.

- 9.4.16 Due to seasonal constraints, baseline data was collected for the following ecological species in the summer and autumn of 2018:
- bat emergence/re-entry surveys (absence results only – data collected in August - September 2018);
 - bat activity surveys (collected in September - October 2018); and
 - Aquatic invertebrate data (collected August 2018).
- 9.4.17 Updated data is to be collected through updated lichen and fungi surveys of Aspbury's Copse potential Local Wildlife Site (pLWS), surveys for which are to be carried out in early 2019.
- 9.4.18 The findings of these 2018 and 2019 surveys shall be submitted either prior to, or during, examination of the DCO application. Although the timing of these surveys has meant that they could not be included within the assessment, the following paragraphs demonstrate how the absence of this information has not limited the assessment.
- 9.4.19 All positive bat roost survey results have been included as part of the assessment, with only negative (i.e. absence) results to be provided as other environmental information. Similarly, a suite of bat activity surveys have been assessed over the periods of July - October 2017 and May – July 2018, and represent the period of highest bat activity (i.e. the maternity period). On this basis, the bat activity survey information from the September and October 2018 surveys relating to bats is not expected to alter the assessment of this group. The range of activity data is therefore considered sufficiently robust to identify and evaluate the potential impacts of the Scheme upon roosting, foraging and commuting bats, to understand impacts and define the scope of appropriate mitigation, and to provide an assessment of any significant effects.
- 9.4.20 Existing baseline data for aquatic invertebrates includes a habitat appraisal and desk study information, and is considered sufficiently robust to identify and evaluate the potential impacts of the Scheme on these features, and to define the scope of mitigation. Accordingly, the data relating to aquatic invertebrates collected in August 2018 is not considered critical for the assessment of likely significant effects.
- 9.4.21 The assessment of potential impacts upon fungi and lichen data has relied on data gathered in 2015 from the ancient woodland within Aspbury's Copse, as part of studies undertaken into the proposed development of a new Motorway Service Area adjacent to this woodland resource [REF 9-36]; [REF 9-37]. Updated surveys of this woodland in 2018 have demonstrated that there have been no significant changes in the nature or extent of woodland habitat, for example, the woodland continues to support a range of standing and fallen deadwood. On this basis, the available baseline fungi and lichen data from 2015 is unlikely to have altered and is therefore considered valid and sufficient for use in the assessment. The updated data to be provided as other environmental information is not considered essential for the assessment of likely significant effects upon these ecological features.

Impact assessment and mitigation

- 9.4.22 The impact assessment has been based on the information obtained and evaluated at the time of reporting, and reflects the Scheme design and the maximum likely extents of land take required for its construction and operation, taking account of the limits of deviation (see Chapter 3 The project).
- 9.4.23 Where data and information are unavailable or incomplete, a precautionary approach¹ has been made of the potential importance of ecological features.
- Habitat loss (permanent and temporary)*
- 9.4.24 The assessment has assumed that all habitats within the limits of deviation surrounding the engineering components of the Scheme will likely be permanently lost through its construction. Within the remainder of the land within the Order Limits, there will also be temporary loss of habitats that coincide with areas identified to accommodate construction compounds and/or ecological mitigation and compensation measures.
- 9.4.25 The assessment has assumed that these temporary impacts will not result in the removal of trees and, except where essential access is required, the majority of boundary features (hedgerows) will be retained with minimum stand-off distances of 5m. Essential access will involve the removal of no more than 10m length of hedgerow at each hedge crossed.
- Bickenhill Meadows SSSI*
- 9.4.26 Bickenhill Meadows SSSI is designated for its species-rich grassland and includes areas of wet meadows and wet alder woodland, and is located in two units situated either side of the new mainline link road:
- First Castle Meadow SSSI unit (referred to as the north western (NW) unit); and
 - Shadowbrook Meadows SSSI unit (referred to as the south eastern (SE) unit),
- 9.4.27 The assessment of effects upon the ecological processes that support the conservation status of the SSSI has been based upon a conceptual model, developed using best available data at the time of the assessment to illustrate how the hydrology of each unit functions and how the grassland communities are maintained.

¹ The CIEEM guidelines for ecological impact assessment [REF-30] define the precautionary principle as, 'The principle that the absence of complete information should not preclude precautionary action to mitigate the risk of significant harm to the environment.' The CIEEM guidelines states that in cases where there is reasonable doubt, and where it is not possible to justify a conclusion that there will be no significant effects, then a significant effect should be assumed.

- 9.4.28 Dipwell monitoring within the SE and NW units of the SSSI commenced in August 2018 and September 2018 respectively, in order to better understand the variability in soil saturation and how long it takes the units sites to drain following heavy rainfall. This information has been used in the development of the conceptual model. Further details of the conceptual model and dipwell monitoring are presented within Appendix 14.2 [TR010027/APP/6.3].
- 9.4.29 As described in Section 9.8, dipwell monitoring will continue for a period of two years post-submission of the DCO application. The ongoing results of this monitoring will be submitted during the examination of the DCO application and will be shared with Natural England. The current available information gathered in relation to the qualifying interest (grassland communities) is, however, considered to be both valid and sufficient to identify and evaluate any potential impacts of the Scheme upon the SSSI (see Section 9.7) and support the design of mitigation measures (see Section 9.8).

9.5 Study area

- 9.5.1 A number of study areas have been defined and applied in the assessment, based on the consideration of the likely zone of influence of the Scheme on ecological features.
- 9.5.2 Study area definition was informed using a combination of professional judgement and guidance contained within the CIEEM guidelines [REF 9-30], which define the zone of influence as: “...the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities”.
- 9.5.3 In defining individual study areas, consideration was given to the geographic location, nature and scale of the Scheme. This referenced the areas of temporary and permanent landtake and limits of deviation defined on the Works Plans [TR010027/APP/2.3], the location and scale of construction compounds, and areas of land identified for environmental mitigation and compensation measures.
- Study areas: desk study*
- 9.5.4 **Table 9.2** presents the study areas applied in the desk study to identify nature conservation sites, protected and notable species, and controlled weed species.
- 9.5.5 The distance applied for international sites is much greater in area than for other sites as this relates to the identification of any internationally designated sites for bats, to ensure that any impacts at this scale could be identified and assessed.

Table 9.2: Study areas applied in the desk study

Ecological feature	Study area
International statutory nature conservation designations	30km
National statutory nature conservation designations	2km
Local statutory nature conservation designations	1km
Non-statutory nature conservation designations	2km
Protected and notable species	2km
Controlled weed species	1km

9.5.6 The extents of the 30km study area are defined in DMRB guidance [REF 9-38], and the extents of the other study areas have been defined using professional judgement, further details of which are presented within Appendix 9.1 [TR010027/APP/6.3].

Study areas: field surveys

9.5.7 **Table 9.3** presents the study areas applied to field surveys.

9.5.8 Further details regarding the definition of these study areas are presented in the associated survey reports within Appendix 9.2 to Appendix 9.14. [TR010027/APP/6.3].

Table 9.3: Study areas applied to field surveys

Field survey	Study area
Extended phase 1 habitat survey (including invasive plant species)	An extended phase 1 habitat survey was undertaken in 2017, and was updated in 2018. As a minimum the habitat survey area covered all accessible locations that were located within 50m of the Order Limits, as illustrated on Figure 9.2B in Appendix 9.2 [TR010027/APP/6.3]. See Appendix 9.2 [TR010027/APP/6.3] for further information.
Phase 2 habitat survey	National Vegetation Community (NVC) surveys were undertaken in 2017 of the semi-improved grasslands located in land parcels east of the B4438 Catherine-de-Barnes Lane, Bickenhill Meadows SSSI and the WGAA facility. In 2018 additional NVC surveys of the grassland at Bickenhill Meadows SSSI were also undertaken. NVC surveys of the ancient woodland at Aspbury's Copse located within the Order Limits were completed in 2017, as illustrated on Figure 9.2C in Appendix 9.2 [TR010027/APP/6.3]. See Appendix 9.2 [TR010027/APP/6.3] for further information.
Hedgerow survey	Hedgerow surveys were undertaken in 2018, and as a minimum covered all accessible locations located within 50m of the Order Limits, as illustrated on Figure 9.3 in Appendix 9.3 [TR010027/APP/6.3]. See Appendix 9.3 [TR010027/APP/6.3] for further information.
Badger (<i>Meles meles</i>) presence/absence and bait marking surveys	In accordance with published guidance [REF 9-39], all badger surveys completed in 2017 and 2018 included accessible habitat within and up to 500m of the Order Limits, as illustrated on Figures 9.4B and 9.4C in Appendix 9.4 [TR010027/APP/6.3] [CONFIDENTIAL]. See Appendix 9.4 [TR010027/APP/6.3] [CONFIDENTIAL] for further information.
Bat surveys, including roost and activity surveys	All accessible trees and structures within 50m of the Order Limits were assessed for their suitability for roosting bats. Surveys included emergence and re-entry surveys, where appropriate. Bat activity surveys consisting of walked transects (in 2017 and 2018) and automated static detector surveys (in 2018 only) were undertaken with the Order Limits, as illustrated on Figure 9.5E in Appendix 9.5 [TR010027/APP/6.3].

Field survey	Study area
	See Appendix 9.5 [TR010027/APP/6.3] for further information.
Breeding birds survey	<p>Transects were undertaken in 2018 to record birds from all habitat within the Order Limits, as illustrated on Figure 9.6A and 9.6B in Appendix 9.6 [TR010027/APP/6.3].</p> <p>See Appendix 9.6 [TR010027/APP/6.3] for further information.</p>
Barn owl (<i>Tyto alba</i>) scoping survey	<p>Scoping and inspection surveys were undertaken to define suitable features and habitat within and adjacent to the Order Limits (outward to a distance of up to 300m), as illustrated on Figure 9.6C in Appendix 9.6 [TR010027/APP/6.3].</p> <p>See Appendix 9.6 [TR010027/APP/6.3] for further information.</p>
Wintering birds survey	<p>All suitable habitat (fields and waterbodies) within and (waterbodies) adjacent to the Order Limits (outward to a distance of 400m) were surveyed, as illustrated on Figure 9.7 in Appendix 9.7 [TR010027/APP/6.3].</p> <p>See Appendix 9.7 [TR010027/APP/6.3] for further information.</p>
Hazel dormouse (<i>Muscardinus avellanarius</i>)	<p>Areas of woodland (including the ancient woodland at Aspbury's Copse) and hedgerows within and bisecting the Order Limits were surveyed.</p> <p>See Appendix 9.8 [TR010027/APP/6.3] for further information.</p>
Great crested newt (<i>Triturus cristatus</i>) survey	<p>Accessible water bodies within 500m of the Order Limits were surveyed, as illustrated on Figure 9.9 in Appendix 9.9 [TR010027/APP/6.3].</p> <p>See Appendix 9.9 [TR010027/APP/6.3] for further information.</p>
Reptile survey	<p>Accessible areas with suitable reptile habitat within and/or adjacent to the Scheme were surveyed for presence/absence, the scope of which comprised fields west of Catherine-de-Barnes Lane, the southern embankment of Clock Interchange, and adjacent field margin and habitat north of the A45 and adjacent to the Arden hotel.</p> <p>See Appendix 9.10 [TR010027/APP/6.3] for further information.</p>
Terrestrial Invertebrates	<p>Two areas were identified as having suitable habitat for notable species: the ancient woodland at Aspbury's Copse pLWS; and the semi-improved neutral grassland south of Bickenhill Meadows SSSI.</p> <p>See Appendix 9.11 [TR010027/APP/6.3] for further information.</p>
Aquatic habitat appraisal	<p>This covered representative waterbodies within areas of land that will be lost to the Scheme and watercourses that cross the Order Limits (comprising Hollywell Brook, Shadow Brook, Kingshurst Brook, and an unnamed watercourse that passes beneath the motorway at SP194821).</p> <p>See Appendix 9.12 [TR010027/APP/6.3] for further information.</p>
White-clawed crayfish (<i>Austropotamobius pallipes</i>) scoping assessment	<p>This covered three watercourses that cross the Order Limits (Hollywell Brook, Shadow Brook, and an unnamed watercourse that passes beneath the motorway at SP194821).</p> <p>See Appendix 9.13 [TR010027/APP/6.3] for further information.</p>

Field survey	Study area
Water vole (<i>Arvicola amphibius</i>)	This covered three watercourses that cross the Order Limits (Hollywell Brook, Shadow Brook, and an unnamed watercourse that passes beneath the motorway at SP194821). See Appendix 9.14 [TR010027/APP/6.3] for further information.
Arboricultural survey	The location, age, species and health of all accessible trees within the Order Limits of the Scheme were identified and mapped. See Appendix 8.2 [TR010027/APP/6.3] for further information.

9.6 Baseline conditions

Nature conservation designations

Statutory international nature conservation designations

9.6.1 The desk study has identified four statutory international nature conservation designations within 30km of the Scheme, the location and qualifying features of which are presented within **Table 9.4**. These sites were identified due to their potential to be hydrologically connected to the Scheme (either because they are sensitive wetland sites or because they are located downstream of watercourses that will be crossed by the Scheme).

9.6.2 None of these four designations are designated for bats.

Table 9.4: Statutory international nature conservation designations within 30km of the Scheme

Designation	Reason(s) for designation	Importance (reasoning)	Relationship to the Scheme
Ensor's Pool SAC	Internationally important population of white-clawed crayfish	International (designated SAC)	16km north east
Fens Pools SAC	Internationally important population of GCN	International (designated SAC)	27km north west
Cannock Extension Canal SAC	Internationally important population of floating water-plantain (<i>Luronium natans</i>)	International (designated SAC)	27km north east
River Mease SAC	Internationally important aquatic vegetation communities and the presence of otter, white clawed crayfish, spined loach (<i>Cobitis taenia</i>) and bullhead (<i>Cottus gobio</i>)	International (designated SAC)	28km north

9.6.3 Full details of these four sites are presented in the Habitats Regulations Assessment: No Significant Effects Report [TR010027/APP/6.8].

Statutory national nature conservation designations

9.6.4 Statutory national nature conservation sites within 2km of the Scheme identified during the desk study are summarised in **Table 9.5**, the locations of which are illustrated on **Figure 9.1A** in Appendix 9.1 [TR010027/APP/6.3].

Table 9.5: Statutory national nature conservation designations within 2km of the Scheme

Designation	Reason(s) for designation	Importance (reasoning)	Relationship to the Scheme
Bickenhill Meadows SSSI/Warwickshire Wildlife Trust (WWT) Nature Reserve)/Ecosite (37/18)	7.2ha of unimproved lowland neutral grassland (MG4/MG5 community) – one of the richest grassland floras in the county.	National (SSSI)	The two management units are both located within the Order Limits.
River Blythe SSSI	39km stretch of lowland river on clay substrate. Botanically, it is one of the richest rivers in lowland England. The habitats present are also important for invertebrate communities.	National (SSSI)	The Order Limits crosses the SSSI at its southern-most extent, just south of Filey Lane. Additional hydrological connectivity with the Scheme via Hollywell Brook and via Shadow Brook and its tributaries.
Coleshill & Bannerly Pools SSSI	37.7ha designated for lowland fen, marsh and swamp and for lowland broadleaved, mixed and yew woodland. The two pools and land between form the only valley mire system in Warwickshire.	National (SSSI)	Located adjacent to the northern extents of the Order Limits.

Statutory local nature conservation sites

9.6.5 The desk study has confirmed that there are no statutory local nature conservation designations (local nature reserves) within 1km of the Scheme.

Non-statutory nature conservation designations

9.6.6 Non-statutory nature conservation designations within 1km of the Scheme identified during the desk study are summarised in **Table 9.6**, and are illustrated on **Figure 9.1B** in Appendix 9.1 [TR010027/APP/6.3].

9.6.7 **Table 9.6** includes all designated sites, as well as potential designations that are believed to meet relevant criteria, but which are yet to be assessed and formally adopted.

Table 9.6: Non-statutory nature conservation designations within 1km of the Scheme

Designation (reference number)	Reason(s) for designation	Importance (reasoning)	Relationship to the Scheme
Aspbury's Copse Ancient Woodland/potential LWS ² (pLWS) (P1)/Ecosite (49/18). Listed on Natural England's Ancient Woodland Inventory ³ [REF 9-33] as Ancient Replanted Woodland.	Ancient woodland (replanted).	County (meets a number of criteria for which an LWS would be designated due to the presence of ancient woodland, indicator species and notable lichen, fungi and invertebrate species. Ancient woodland is also a HPI).	Located on land required for construction of the Scheme.
Hollywell Brook corridor to A41 pLWS (P13)/ Ecosite (76/28)	Aquatic habitats and associated grassland, woodland and artificial ponds.	Up to County (pLWS)	The watercourse crosses the Order Limits.
Castle Hill Farm Meadows LWS (L2)/ Clock Lane Meadows Ecosite (53/18)	This LWS is one of the largest and most important grasslands in the county.	Regional (LWS; species-rich grasslands of this type and quality are rare nationally).	A section of the Order Limits is located within part of the LWS.
Barber's Coppice Ecosite (05/18)/Listed on Natural England's Ancient Woodland Inventory [REF 9-33] as Ancient Woodland Replanted	Mixed woodland with some acidic ground flora.	Up to County (importance advised by citation).	Located adjacent to the Order Limits
Main Birmingham to London Railway Line Ecosite (21/18)	Marginal habitat of some value as a refuge and distribution corridor for nesting birds and other local species.	Local (importance advised by citation)	Located adjacent to the Order Limits.
Hen Wood and Hen Wood Meadow LWS (L20)	Damp meadow adjacent to River Blythe SSSI that supports a variety of grasses and herbs.	County (LWS).	Location adjacent to the southernmost extents of the Order Limits.

² The citation for Aspbury's Copse pLWS names the designation as 'Aspbury's Coppice'; however, for the purposes of this assessment and other assessments reported within the Environmental Statement the designation has been referenced as 'Aspbury's Copse'.

³ The designated boundary of ancient woodland as Aspbury's Copse has recently been amended by Natural England [REF-33]. This revised boundary has been adopted in the assessment, and is considered to represent the area of irreplaceable ancient woodland habitat at Aspbury's Copse.

Designation (reference number)	Reason(s) for designation	Importance (reasoning)	Relationship to the Scheme
Disused Railway & Sidings pLWS (P8)/disused Track and Siding Wood Ecosite (25/28B)	A disused railway with overgrown and neglected hedgerows of oak (<i>Quercus</i> sp.), ash (<i>Fraxinus excelsior</i>) and hawthorn (<i>Crataegus monogyna</i>).	Up to County (pLWS).	Located adjacent to the eastern boundary of the Order Limits.
Coleshill Pool Wood LWS (07/18)	Oak woodland with frequent birch (<i>Betula</i> sp.)	County (LWS)	Located adjacent to the northernmost extents of the Order Limits.
Catherine-de-Barnes Meadows Ecosite (36/18)	Species-rich grassland.	Up to County (importance advised by citation).	Located adjacent the south western boundary of the Order Limits.
Greens Ward Piece LWS (L7) (part of Shadowbrook Lane Meadows Warwickshire Wildlife Trust (WWT) Nature Reserve) / Ecosite (37/18)	Small field of unimproved pasture.	County (LWS).	Located within the Order Limits.
Wayside Cottages Meadow LWS (55/18)	A field of largely unimproved herb-rich grassland.	County (LWS).	Located approximately 30m west of the Order Limits.
Pendigo Lake & The Rough Ecosite (33/18)	Not available.	Up to County (Ecosite).	Located approximately 30m west of the Order Limits.
Marsh adjacent to River Blythe pLWS (P16)	Marsh area next to the River Blythe.	Up to County (pLWS).	Located approximately 80m east of the Order Limits.
Bickenhill Churchyard Ecosite (41/18)	Limited ecological information available; likely to be semi-improved or unimproved grassland.	Local (Parish) (importance advised by citation).	Located approximately 85m east of the Order Limits.
Henwood Mill LWS (L10).	Wet woodland mostly dominated by alder (<i>Alnus glutinosa</i>).	County (LWS).	Located approximately 130m west of the southern extent of the Order Limits.
Land by Henwood Tip pLWS (P15)	Wet alder coppice with crack willow and an understory of scattered elder.	Up to County (pLWS).	Located approximately 160m north west of the Order Limits.

Designation (reference number)	Reason(s) for designation	Importance (reasoning)	Relationship to the Scheme
Pond at Hampton Manor Wood North pLWS (P20) / Hampton Manor Grounds & Churchyard & Hampton in Arden Spinney Ecosite (70/28)	Broadleaved plantation with diverse range of species and relatively species-rich grassland area.	Up to County (pLWS).	Located approximately 400m east the Order Limits.
Grand Union Canal pLWS (P11)	The banks and canal support a varied flora.	County (importance advised by citation).	Closest point is located approximately 200m west of the southern extents of the Order Limits.
Denbigh Spinney LWS (L4)	Broadleaved semi-natural woodland with abundant alder.	County (pLWS).	Located approximately 450m east of the Order Limits.
Henwood Tip LWS (L11)	Poor wet semi-improved grassland with undulating hollows and ridges	County (LWS).	Located approximately 355m west of the southernmost extent of the Order Limits.
Kingshurst Brook/Low Brook, headwaters and Tributaries pLWS (P14)/ Ecosite (16/18V)	The brook and banks supports a diverse range of flora.	Up to County (pLWS).	Located adjacent to the western boundary of the Order Limits.
Terrets and Pool pLWS (P27)	Alder woodland	County (importance advised by citation)	Located approximately 500m west of the southern extents of the Order Limits.
Bickenhill Plantation LWS (L1)	Coniferous plantation and birch woodland.	County (LWS).	Located approximately 550m west of the Order Limits.
GCN pond deferred LWS (D2) pLWS	Open and poorly vegetated, reported to support GCN, there are no specific records to confirm presence.	Up to County (pLWS).	Located approximately 730m west of the southern extents of the Order Limits.
Pumells Brook Woodland (L14)	Sycamore (<i>Acer pseudoplatanus</i>) and alder woodland.	County (LWS).	Located approximately 800m south of the Order Limits.
Brick Kiln Hole Wood pLWS (P4)	Two areas of woodland.	Up to County (pLWS designated by SMBC).	Located approximately 830m north west of the Order Limits.

Designation (reference number)	Reason(s) for designation	Importance (reasoning)	Relationship to the Scheme
Hedgerow pLWS (P12)	Hedgerow bordering a range of habitats, including mixed plantation, arable, improved grassland and tall ruderal.	Up to County (pLWS designated by SMBC).	Located approximately 880m south east of the Order Limits.
Purnells Brook Woodland LWS/Purnells Brook Meadows pLWS (P23)	Woodland and semi-improved grassland.	County (LWS designated by SMBC).	Located approximately 880m south of the Order Limits

Habitats

- 9.6.8 The study area is mainly rural, comprising mostly arable fields, with a scatter of improved grass fields and a few semi-improved or unimproved neutral grasslands, including some within designated sites.
- 9.6.9 The study area retains a relatively intact network of hedges with a scatter of mature trees. There are a few field ponds present and small tributaries that feed into the River Blythe, which winds through the study area. There are several small blocks of woodland, including ancient woodland sites. The north of the study area is characterised by urban development, with limited areas of habitat within this development and within the soft estate of the M42 motorway.
- 9.6.10 The habitats beyond the boundary of designated sites that are present within the study area are summarised in **Table 9.7**. The locations of these habitats are illustrated on **Figures 9.2B** and **9.3** in Appendix 9.2 and Appendix 9.3 [TR010027/APP/6.3] respectively.
- 9.6.11 Full habitat details are presented in Appendix 9.2 [TR010027/APP/6.3] and Appendix 9.3 [TR010027/APP/6.3].

Table 9.7: Habitats present within the Phase 1 habitat study area

Designation (reference number)	Importance	Reasoning	Relationship to the Scheme
Broadleaved semi-natural and mixed semi-natural woodland	Local	A small area of wet woodland that is characteristically species-poor (associated with pond 39). Wet woodland is a HPI and Priority Habitat of the LBAP. 3.12% of Warwickshire is covered by broadleaved semi-natural woodland. Wet woodland is represented locally in association with the River Blythe and its tributaries, although at a County level the resource of wet woodland is poorly understood [REF 9-18] Overall, the importance of this woodland is limited by its small extent.	Located in the central area of the Scheme.
Plantation woodland	Local	These species-poor plantation woodlands are not considered HPIs, but are likely to qualify as LBAP habitat.	Scattered across the Scheme.
Scattered trees	Negligible	Common and widespread habitat type.	Scattered across the Order Limits.
Scattered and dense / continuous scrub	Local	Small areas present within Scheme boundary. Common habitat found within the surrounding area.	Small areas within the Order Limits.
Hedgerow	Local and up to County	Hedgerows are a HPI and LBAP habitat. A network of Important and species-rich hedgerows is present and assessed as of County importance (H20, H24, H25, H26, H34, H38, H40, H43, H45, H98B and H105). As a precaution all hedgerows that were inaccessible to survey are considered to be of up to County importance. All remaining hedgerows are considered to be of Local importance.	Hedgerows are located across the central areas of the Scheme, with a network of species-rich and/or important hedgerows located north of the B4102 Solihull Road (Solihull Road).
Arable	Negligible	Present within the Order Limits. Dominant habitat found within the surrounding area both to the east and west of the M42 motorway. The habitat is species-poor with no notable field margins or arable weeds recorded.	Within the Order Limits.
Improved grassland	Negligible	A common habitat present within the Order Limits and within the wider landscape. Improved grassland is species-poor and with no notable plants present.	Within the Order Limits.

Designation (reference number)	Importance	Reasoning	Relationship to the Scheme
Amenity grassland	Negligible	Common habitat found within the surrounding area and typically subject to intensive management that limits its ecological importance.	Within the Order Limits.
Ephemeral- short-perennial	Negligible	Limited areas of an early successional habitat that is common and widespread.	Associated with derelict ground to the north of the Scheme.
Semi-improved grassland	Local	Limited areas of species-poor neutral grassland (excluding SSSIs, LWSs and Ecosites).	Scattered across the Scheme.
Marshy grassland	Local	Limited area of marshy grassland east of the M42 motorway.	Outside the Order Limits.
Ponds	Local	16 ponds within the study area: 8, 9, 17, 19, 20, 21, 34, 35, 36, 39, 40, 41, 42, 43, 44 and 45. Ponds 8, 39, 42 and 45 were either dry or ephemeral, with the remainder being continually wet. All ponds are either largely over-shaded and/or species-poor. All ponds are Priority Habitat of the LBAP. Pond 36 supports GCN and is therefore a HPI. Pond 19 was inaccessible and is therefore also assumed to be a HPI. Pond 39 is associated with wet woodland habitat (above). Pond 41 is located within with Greens Ward Piece LWS.	All ponds located within 50m of the Order Limits. Only the ephemeral ponds 8, 39 and 43 will be lost to the Scheme.
Running Water (Shadow Brook and unnamed watercourse)	Local	Streams are species-poor and within limited structural diversity. The importance of these streams is increased due to their connection with the River Blythe SSSI.	Within the Order Limits.
Ditches	Negligible	Dry ditches that are a widespread habitat typical of agricultural habitats.	Scattered across the Scheme and along field boundaries
Buildings, hardstanding and gardens	Negligible	Widespread urban habitat.	Associated with the road surfaces and the residential areas of Bickenhill

Protected and notable species

9.6.12 The following protected and notable species have been identified by the desk study and field surveys.

Badger

9.6.13 Due to the confidential nature of badger sett information, the full details of the badger survey and assessment data are presented in a confidential report within Appendix 9.4 [TR010027/APP/6.3] [CONFIDENTIAL].

9.6.14 In summary, there are a number of badger setts within the badger study area, and investigation using bait marking has confirmed that there are at least three separate badger clans.

9.6.15 Badgers are a common and widespread species, and the population present is considered to be of Local importance.

Bats

9.6.16 The full details of the bat surveys are presented in Appendix 9.5 [TR010027/APP/6.3].

9.6.17 The desk study has identified that a range of bat species roost within the study area including common pipistrelle *Pipistrellus pipistrellus*, soprano pipistrelle *P. pygmaeus*, Daubenton's bat *Myotis daubentonii*, Leisler's bat *Nyctalus leisleri* and brown long-eared bat *Plecotus auritus*. Non-roosting records of noctule *Nyctalus noctula*, serotine *Eptesicus serotinus* and Natterer's bat *M. nattereri* were also identified.

9.6.18 Trees, woodlands and structures with features suitable for roosting bats are located within and adjacent to the Order Limits. A small common pipistrelle (4 adults) and brown long-eared bat (1 adult) roost is present within Building B1. Common pipistrelle and soprano bat roosts (one or two individuals) have been confirmed within or adjacent to the Scheme in trees T17, T21, T80, T83 (Bickenhill Meadows SSSI), T85.2 and T242 (Aspbury's Copse pLWS). Small common pipistrelle bat roosts have also been confirmed by others in the boundary of the Scheme in trees T54, T124 and T215 (Aspbury's Copse pLWS), although no bats were recorded entering or emerging from these trees during separate surveys in 2018 (see Appendix 9.5 [TR010027/APP/6.3]).

9.6.19 Brown long-eared bats and soprano pipistrelle are SPIs and all bats are Priority Species in the LBAP. These represent low status (non-breeding) roosts of species that are common and widespread, and are therefore considered to be of no more than Local importance. No other bat roosts have been recorded within the Order Limits.

9.6.20 Woodlands, grassland, arable fields, water bodies and hedgerows are suitable for foraging and commuting bats. The bat activity surveys completed between July and October 2017 and between May and July 2018 has recorded bat foraging and commuting activity on all transects across the Scheme.

- 9.6.21 Most bat activity was associated with common pipistrelle, with soprano pipistrelle, noctule, *Nyctalus* species, *Myotis* and serotine species recorded only occasionally. The levels of activity are considered to be low and typical of the habitats present. The highest levels of bat activity recorded were along hedgerows in fields to the west of Catherine-de-Barnes Lane and in the vicinity of Aspbury's Copse pLWS. Bat activity was also recorded along hedgerows, tree lines and plantation woodland immediately east of the M42 and along hedgerows between Catherine-de-Barnes Lane and the M42. The lowest levels of bat activity were recorded in the north of the study area to the east of Catherine-de-Barnes Lane.
- 9.6.22 The assemblage of bat species present is not considered to meet any of the Warwickshire LWS species selection criteria [REF 9-41]. Evaluation of the bat assemblage using the principles described by Wray *et al* (2010) [REF 9-42] indicated that the activity is of Local/District importance. The occasional occurrence of serotine bat is also considered to be consistent with the known occurrence of this species in the local area. Overall the assemblage of bats is considered to be consistent with the local records and unexceptional. On this basis, the foraging and commuting habitats present are considered to be of no more than Local importance.

Breeding birds

- 9.6.23 The full details of the breeding bird surveys are presented in Appendix 9.6 [TR010027/APP/6.3].
- 9.6.24 The desk study returned records of four Schedule 1 species contained within the Wildlife and Countryside Act 1981 (as amended) [REF 9-5] within 1km of the Order Limits in the last ten years, namely: barn owl (considered separately in the following section); fieldfare *Turdus pilaris*; redwing *Turdus iliacus*; and wryneck *Jynx torquilla*. Field fare and redwing are a widespread species that only over-winter in this region, and wryneck is a passage species with a largely coastal distribution, and therefore none of these three species breed in this county.
- 9.6.25 A total of 35 breeding bird species was recorded during the surveys, consisting of: six Red List; three Amber List; and 26 Green List species, as defined by the Royal Society for the Protection of Birds [REF 9-43]. The farmland to the south of the A45 Coventry Road (A45) supports two notable species (Red List skylark and yellowhammer) which are also included as key features within the Farmland Bird LBAP for Warwickshire, Coventry and Solihull [REF 9-44].
- 9.6.26 Breeding skylark was also found to the east of the M42 motorway. Skylark is a widely distributed species and its population density is considered to be relatively stable at a regional level. Yellowhammer is also a widely distributed species, and as reported in the Warwickshire Farmland Bird BAP [REF 9-44] they are known to have recently increased in numbers and range within Warwickshire.

9.6.27 Many of the other Amber and Red List species (bullfinch, dunnock, linnet, mistle thrush and song thrush) breeding within their study areas were associated with hedgerows and scrub, and are typically associated with those habitats. Linnet is also a key species of the Warwickshire Farmland Bird LBAP [REF 9-44], and is known to have recently demonstrated increases in numbers and range in the county. Therefore, as it is typical of the farmland habitats present, the assemblage of breeding birds is considered to be of Local importance.

Barn owl

9.6.28 During barn owl surveys, eight features were appraised as offering potential nest sites for barn owl, consisting of six trees and two man-made structures, the details of which are presented within Appendix 9.6 [TR010027/APP/6.3].

9.6.29 No evidence of breeding was recorded in association with any of these features; however, anecdotal evidence and incidental observations made during the surveys suggest that some of these features are used on an occasional basis for roosting.

9.6.30 The habitat assessment indicated that rough grassland in the north west area of the Scheme, located south of Birmingham Airport and the A45, has potential to support foraging barn owls. This was supported by the desk study data and the occasional observations of barn owl in this location.

9.6.31 Barn owls are sparsely distributed in Warwickshire, with estimates of approximately 100 breeding pairs in the county [REF 9-45]. The population of barn owl that appears to make occasional use of habitats within the Order Limits for foraging and roosting is considered to be of Local importance.

Wintering birds

9.6.32 The full details of wintering bird surveys are presented in Appendix 9.7 [TR010027/APP/6.3].

9.6.33 The results of the wintering bird surveys completed between October 2017 and March 2018 indicate that habitats within the study area do not support notable species or assemblages of wintering birds. The main habitats of interest for the recorded wetland bird species, which were present in small numbers, are the water bodies and watercourses within the study area.

9.6.34 Other non-wetland species of conservation interest, including SPIs and Species of Conservation Concern [REF 9-43], include the passerines redwing, fieldfare, mistle thrush, dunnock *Turdus viscivorus* and bullfinch *Pyrrhula pyrrhula*, which were recorded in relatively small numbers using habitats within the Order Limits (for example hedgerows and woodland).

9.6.35 As the wintering bird assemblage comprises common and widespread species, with no significant flocks recorded, this is considered to be of no more than Local importance.

Hazel dormouse

9.6.36 The full details of the dormouse surveys are presented in Appendix 9.8 [TR010027/APP/6.3].

- 9.6.37 The status of the species in the county is relatively well understood because they are recorded at a small number of sites [REF 9-46], and it is known to be very rare and of very localised distribution. No records were returned during the desk study, and a specific dormouse nest tube survey completed in 2017 did not find any evidence this species.
- 9.6.38 This is consistent with the poor availability of suitable habitat, which is dominated by intensively managed hedgerows and fragmented by nearby roads including the M42 motorway and the A45. It is also consistent with surveys completed in the wider area for the High Speed 2 (HS2) development [REF 9-47], the alignment of which is located to the north and east of the Order Limits.
- 9.6.39 Based on this combined evidence, it is considered reasonable to conclude that dormice are absent. Accordingly, this species has been scoped out of further consideration in the assessment.

Otter

- 9.6.40 Information gathered during the desk study and from consultation with the Environment Agency (see Appendix 9.17 [TR010027/APP/6.3]) confirmed the presence of otter on Hollywell Brook, the River Blythe and the Grand Union Canal, with the majority of records relating to the River Blythe. Consistent with this, a single otter spraint was incidentally recorded on Hollywell Brook in August 2018. It is considered that otter likely use all watercourses within the Order Limits at least on an occasional basis.
- 9.6.41 In line with the comments made by the Environment Agency (see Appendix 9.17 [TR010027/APP/6.3]), field surveys were not considered necessary to evaluate the status of the local otter population because this species are likely to be present on all watercourses. .
- 9.6.42 Otters typically have home ranges in the order of 11 to 18km of a main river and its associated tributaries. Given these typical territory sizes, it is considered that the study area will be very unlikely to sustain more than one or two breeding pairs of otter. The Warwickshire otter population was considered to be 10 to 20 animals in 2012 [REF 9-48], and therefore at most one breeding pair will be 10 to 20% of the county population.
- 9.6.43 Accordingly, the otter population in this area is considered to be of up to County importance.

Water vole

- 9.6.44 The full details of the water vole survey are presented in Appendix 9.14 [TR010027/APP/6.3].
- 9.6.45 No records for water vole were returned as part of the desk study, and the water vole survey in 2017 found no evidence of water vole. This is consistent with the known distribution of this species in Warwickshire, which is limited to areas north of Coventry [REF 9-49], and is also further supported by the results of water vole surveys for HS2, which in both 2012 and 2013 found no evidence of water vole following surveys of the River Blythe and its tributaries, Hollywell Brook and its tributaries, and the Shadow Brook in 2012 and 2013 [REF 9-47].

9.6.46 It is considered that water vole is not currently present within the study area, but there remains the possibility of re-colonisation by the species in the future. On this basis, water vole are considered to be of Negligible (less than Local) importance.

Hedgehog

9.6.47 Hedgehog droppings were noted within the boundary of Bickenhill Meadows SSSI in September 2018, which is consistent with desk study data that indicates hedgehog is widespread in the local area. The mix of woodland, hedgerows, scrub and rough grassland within the Scheme and surrounding area provides suitable potential habitat for hedgehog.

9.6.48 Hedgehogs are a SPI and are Priority Species of the LBAP [REF 9-50]. They may range over areas of 10ha (females) to 32ha (males) [REF 9-51].

9.6.49 Although they have a widespread distribution, hedgehog populations are known to have declined and therefore the population present is considered to be of Local importance.

Polecat

9.6.50 A single polecat (confirmed by DNA analysis) road mortality was recorded on Catherine-de-Barnes Lane in September 2018, a period when this species is likely to be dispersing. The desk study records indicate that this species is present on the eastern fringes of Solihull. The arable farmland with cover provided by scattered hedgerows and trees is likely to provide suitable habitat for polecat. Numerous animal holes within the Order Limits are likely to provide potential breeding habitat for polecat.

9.6.51 Polecats are a widely distributed species with populations known to be increasing nationally and within Warwickshire [REF 9-52]. This species has a home range of 183ha and are a wide-ranging species that make opportunistic use of places of shelter (dens) [REF 9-53]. Polecats are a SPI under s41 of the NERC Act [REF 9-7].

9.6.52 As polecats are likely to make only occasional or opportunistic use of the habitats within the Order Limits the population is considered to be of Negligible (less than Local) importance.

Harvest mouse

9.6.53 There are previous records of harvest mouse from 2000 within the boundary of the NW unit of Bickenhill Meadows SSSI. The tall, tussocky grasslands and patches of scrub associated with this unit of the SSSI, and the habitats associated with Castle Hill Farm Meadows LWS, are likely to provide suitable habitat for harvest mouse.

9.6.54 The intensively managed arable fields and grazed grasslands in the remainder of the Scheme represent poor harvest mouse habitat. Harvest mouse is a SPI and that is likely to have a localised and fragmented distribution across the county.

9.6.55 The harvest mouse population is considered to be of Local importance.

Great crested newt

- 9.6.56 The full details of the GCN surveys are presented in Appendix 9.9 [TR010027/APP/6.3].
- 9.6.57 GCN are widespread in lowland England, including Warwickshire [REF 9-54].
- 9.6.58 During field surveys in 2017, populations of GCN were recorded in six ponds located within 500m of the Order Limits, as illustrated on **Figure 9.9** in Appendix 9.9 [TR010027/APP/6.3], specifically:
- pond 6 with a peak count of one and pond 7 with a peak count of five, are in close proximity to each other and considered to form a metapopulation with a combined peak count of six newts, which corresponds to a small population (less than ten adults);
 - pond 11 with a peak count eight and pond 12 with a peak count of one, are in close proximity to each other and considered to form a metapopulation with a combined peak count of nine newts, which corresponds to a small population. As a survey undertaken by others in 2018 [REF 9-55] identified a Medium meta-population (peak count 15 adults) in ponds 11 and 12, this represents the population status applied in the assessment;
 - pond 13 with a peak count of eight, which corresponds to a small population; and
 - pond 36 with a peak count of two, which corresponds to a small population, Environmental DNA survey in 2018 did not identify GCN from this pond. Applying the precautionary principle, a small GCN population is assumed to be present.
- 9.6.59 GCN were confirmed to be absent from all of the remaining ponds that were accessible to survey in 2017 and 2018.
- 9.6.60 Pond 19, which is located approximately 40m from the Order Limits, was inaccessible to survey in 2017 and 2018. As a precaution, and based upon the status of populations present in the surrounding area, it is assumed that this pond supports a medium GCN population.
- 9.6.61 All other inaccessible ponds were considered to be separated from the Scheme by barriers to the dispersal of GCN, for example as roads, flowing water or generally unsuitable habitat (intensively managed arable or pasture). Therefore, any GCN that may be present in these ponds are unlikely to make use of the habitats within the Order Limits, and accordingly do not represent a constraint.
- 9.6.62 The small and medium populations present in a proportion of ponds are considered to be consistent with the known distribution of local records. On this basis the GCN populations are considered to be of Local importance.

Reptiles

- 9.6.63 The full details of the reptile surveys are presented in Appendix 9.10 [TR010027/APP/6.3].

- 9.6.64 The desk study identified one slow worm (*Anguis fragilis*) record from Hampton in Arden train station in 2014, approximately 970m from the Order Limits. There were no other reptile records within the last ten years.
- 9.6.65 Most of the habitats on the land within the Order Limits comprise arable fields and improved grassland that are intensively managed and unsuitable for reptiles, or that will otherwise be unlikely to support site faithful populations of reptiles.
- 9.6.66 Selected areas of suitable reptile habitat are present within or adjacent to the Order Limits. Reptile presence/absence surveys of these areas was completed during suitable weather conditions in June – July 2017, and in June – October 2018, in accordance with best practice guidelines [REF 9-56];[REF 9-57]. The areas covered by the surveys comprised:
- fields to the west of Catherine-de-Barnes Lane (central grid references SP183822, SP182818, SP184819 and SP183813);
 - the embankments of Clock Interchange and adjacent field margins (central grid reference: SP189829 and SP186828); and
 - a small area of rough grassland located north of the A45 and immediately adjacent to the railway embankment (central grid reference SP191830).
- 9.6.67 No reptiles were recorded during the surveys.
- 9.6.68 As detailed Section 9.4, some areas of suitable habitat located within the Order Limits were not accessible to survey (the banks of Hollywell Brook pLWS and an area of land south west of existing M42 Junction 6 (central grid reference SP 195828)). It is relevant that the latter area is connected via the railway line to suitable habitat north of the A45 where reptiles were confirmed to be absent.
- 9.6.69 Given the absence of reptiles from field surveys and the absence of local records, it is reasonable to conclude that reptiles are also absent from these areas; however, as a precaution and as agreed in consultation with the Environment Agency (see Appendix 9.17 [TR010027/APP/6.3]), at most some suitable habitat may be used on an occasional basis by grass snake, which is a mobile and wide-ranging species. Therefore, the suitable areas of reptile habitats are considered to be of Negligible (less than Local) importance for grass snake only, and all other reptile species are considered to be absent.

Terrestrial invertebrates

- 9.6.70 The full details of the terrestrial invertebrate surveys are presented in Appendix 9.11 [TR010027/APP/6.3].
- 9.6.71 The desk study identified a large number of records of protected and notable species of terrestrial invertebrates within the search area from the past 10 years. This includes 36 SPIs listed on Schedule 41 of the NERC Act [REF 9-7], as well as International Union for the Conservation of Nature Red Data Book [REF 9-58] and Nationally Scarce species.

- 9.6.72 Terrestrial invertebrate surveys were completed between June and September 2017 in accordance with Natural England standing advice [REF 9-59], and focussed on two areas of habitat of value to terrestrial invertebrates within and adjacent to the Scheme (comprising one field of semi-improved neutral grassland, and Aspbury's Copse). The surveys recorded the following:
- a. Aspbury's Copse – 216 species. This included two nationally scarce species, a tumbling flower beetle (*Mordellistena variegata*) and a solitary wasp (*Crossocerus binotatus*); and
 - b. semi-improved neutral grassland – 309 species. This included three SPIs for nature conservation in England contained within section 41 of the NERC Act [REF 9-7], moth species cinnabar (*Tyria jacobaeae*), shaded broad-bar (*Scotopteryx chenopodiata*) and latticed heath (*Chiasmia clathrata*), which are not of conservation concern⁴, and three nationally scarce species comprising a semi-aquatic beetle (*Elodes minuta*), a weevil (*Oxystoma cerdo*), and sharp-collared furrow bee (*Lasioglossum malachurum*).
- 9.6.73 Both of these areas are considered to contribute quality habitat and connectivity for invertebrates as part of the wider landscape.
- 9.6.74 On this basis and given the presence of a small number of notable species, Aspbury's Copse is considered to be of County importance for invertebrates. The semi-improved grasslands are considered to be of Local importance for the maintenance of terrestrial invertebrate biodiversity.
- Aquatic invertebrates*
- 9.6.75 There are a number of ponds and watercourses present (Hollywell Brook pLWS, Shadow Brook and its tributaries, and Kingshurst Brook pLWS) within the Order Limits.
- 9.6.76 Surveys for HS2 in 2013 [REF 9-47] covered Hollywell Brook and Shadow Brook, and therefore coincided with the study area. These surveys recorded the following:
- a. Shadow Brook – a high invertebrate diversity comprising mostly common species with the exception of locally common leech and caddisfly. Based on the biological and environmental data collected, Shadow Brook was assessed as being of moderate overall quality; and
 - b. Hollywell Brook – a moderate invertebrate diversity comprising common and widespread species. Based on the biological and environmental data collected, Hollywell Brook was assessed as being of moderate overall quality.

⁴ These species of principal importance were originally included within the UK BAP [REF 9-32] for research purposes only.

- 9.6.77 An appraisal of the aquatic habitats of selected ponds (10, 39 and 45) and the watercourses of Hollywell Brook pLWS, Shadow Brook and its tributaries and Kingshurst Brook pLWS has also been undertaken in 2018 (see Appendix 9.12 [TR010027/APP/6.3]). This has demonstrated that the habitat of Hollywell Brook, which was the largest watercourse surveyed, had the highest overall structural and botanical diversity. The remaining watercourses were small, being over-shaded and having limited structural diversity. In particular some sections of Shadow Brook were dry at the time of survey.
- 9.6.78 Based upon this habitat appraisal, it is considered that the habitats are unlikely to have altered in suitability or importance for aquatic invertebrates. Therefore, the baseline data is sufficient to evaluate the likely importance of the ponds and watercourses for aquatic invertebrates. Notwithstanding this, details of aquatic invertebrates will be provided as other environmental information prior to, or during, examination of the DCO application, as noted in Section 9.4.
- 9.6.79 The ponds within the Order Limits, which are ephemeral and over-shaded features that lack botanical or structural diversity, are considered to be of no more than Local importance for aquatic invertebrates. It is considered that at most the watercourses within the Order Limits are of County importance for aquatic invertebrates.
- White-clawed crayfish*
- 9.6.80 As requested by consultation with the Environment Agency (see Appendix 9.17 [TR010027/APP/6.3]), the desk study identified records of 22 white-clawed crayfish on Low Brook south of the A41 in 2011. The closest of these records was located over 400m from the Order Limits.
- 9.6.81 The LBAP reported a good population on Low Brook in 2014 near Birmingham Airport [REF 9-60]. Low Brook is part of Kingshurst Brook/Low Brook, headwaters and Tributaries pLWS, and its headwaters arise from watercourses that are located along the western extents of the Order Limits. This watercourse is heavily over-shaded, silted and some sections were completely dry during 2017 – 2018. Therefore, although white-clawed crayfish are present on the downstream sections of Low Brook, it is considered that the habitats within the Order Limits are unsuitable for this species and it is unlikely to be present.
- 9.6.82 A white-clawed crayfish scoping assessment was completed on watercourses potentially affected by the Scheme within 1km of the mainline link road to assess the suitability of each watercourse for white-clawed crayfish. The full details of this scoping assessment are presented within Appendix 9.13 [TR010027/APP/6.3].
- 9.6.83 Field surveys focussed on three watercourses: Hollywell Brook, Shadow Brook, and an unnamed watercourse and recorded evidence of the non-native invasive species American signal crayfish *Pacifastacus leniusculus* on Hollywell Brook in 2017 and evidence of this species was also recorded in 2018.

9.6.84 This non-native species out-competes white-clawed crayfish and carries crayfish plague which is fatal to white-clawed crayfish. White-clawed crayfish are therefore unlikely to be present and no evidence of this species was recorded. The habitat of Shadow Brook and the unnamed watercourse were considered to be unsuitable for white-clawed crayfish due to a lack of refugia and the abundance of silt.

9.6.85 Based on the poor quality of available habitat and/or the presence American signal crayfish, it is considered reasonable to conclude that white-clawed crayfish are absent from these watercourses.

Fish

9.6.86 Fish surveys undertaken as part of the HS2 project in 2013 [REF 9-47] found that Hollywell Brook and Shadow Brook are of poor habitat quality for fish, and no notable fish species were recorded.

9.6.87 This situation is unlikely to have changed over the intervening period, particularly given the characteristics of the relevant watercourses which are considered likely only to support common and widespread species (see Appendix 9.12 [TR010027/APP/6.3]).

9.6.88 No further fish surveys were considered necessary for the purpose of the assessment, and all relevant watercourses are considered to be of no more than Local importance for fish.

Fungi

9.6.89 A targeted fungi survey of Aspbury's Copse pLWS ancient woodland was undertaken and reported in 2015 as part of the planning application for the MSA development proposal [REF 9-36], which reported moderately high species-richness across Aspbury's Copse and identified species present that are considered typical of ancient woodlands.

9.6.90 Aspbury's Copse pLWS represents a relatively undisturbed area of ancient woodland within private ownership. Field surveys completed in 2017 and 2018 confirmed that the composition and structure of the woodland has not altered significantly, and that it continues to support a range of standing and fallen deadwood. Several notable fungi were recorded, but none of these were species listed in the Red Data List [REF 9-58] of threatened British fungi.

9.6.91 On this basis, the baseline fungi data from 2015 is unlikely to have altered and is considered to be valid and sufficient for the purposes of the assessment.

9.6.92 Aspbury's Copse is considered to be of County importance for fungi.

Lichens

- 9.6.93 A targeted lichen survey of Aspbury's Copse pLWS ancient woodland was undertaken and reported as part of the planning application for the MSA development proposal [REF 9-37]. This reported that the eastern half of Aspbury's Copse supported relatively common and widespread lichen species, with the western parts supporting a richer diversity of lichen species including three nationally scarce species: *Bacidia fresiana*, *B. sulphurella* and *Normadina pulchella*.
- 9.6.94 Aspbury's Copse pLWS represents a relatively undisturbed area of ancient woodland within private ownership. Field survey completed in 2017 and 2018 confirmed that its composition and structure have not altered significantly.
- 9.6.95 On this basis, the baseline lichen data from 2015 is unlikely to have altered and is considered to be valid and sufficient for the purposes of the assessment.
- 9.6.96 It is therefore concluded that Aspbury's Copse is of Regional importance for these lichen species.

Flora

- 9.6.97 The desk study identified records of native black poplar *Populus nigra ssp. betulifolia* within the study area. These records were located on the eastern edge of Aspbury's Copse pLWS and to the south east of M42 Junction 6; however, none of these were recorded during the Phase 1 habitat survey or Woodland NVC surveys (see Appendix 9.2 [TR010027/APP/6.3]).
- 9.6.98 The field surveys recorded poplar species and hybrid black poplar only. Native black poplar is a Priority Species of the LBAP [REF 9-61]. As there are almost 600 records in Warwickshire, the species is considered to be of up to County importance, but as no specimens have been found in the surveys this is not applicable.
- 9.6.99 The desk study identified a large number of records of county rare plants within the 1km search area from the past ten years, including 20 red list species. None of these species were recorded during the 2017 or 2018 Phase 1 Habitat surveys or more detailed botanical surveys in the woodland, grassland, wetland and hedgerow habitat (see Appendix 9.2 [TR010027/APP/6.3] and Appendix 9.3 [TR010027/APP/6.3]).

Controlled weed species

- 9.6.100 Field surveys identified a stand of Japanese knotweed *Fallopia japonica* located adjacent to pond 39 north of Solihull Road, within the Order Limits.
- 9.6.101 Water fern *Azolla filiculoides* was also located to the east of the Order Limits. It is not considered appropriate to attribute the same weight to these non-native species as has been applied to relevant ecological features.

Future baseline

- 9.6.102 Professional judgement has been used to predict the natural and man-made influences that are likely to change the baseline conditions recorded within the assessment from 2017/2018, through the construction period (2020 to 2023), to the opening of the Scheme in 2023.
- 9.6.103 In relation to the future baseline conditions that are likely to exist in 2020 in the absence of the Scheme, the existing conditions recorded in 2017/2018 within and surrounding the Order Limits are unlikely to have changed markedly by this point. Furthermore, it is not anticipated that any large-scale changes in agriculture policies and practices will occur.
- 9.6.104 Planned development relating to HS2 and its associated infrastructure, mineral extraction and industrial developments in the wider area are expected to influence habitats and fauna on land surrounding the Order Limits by 2020, resulting in the localised loss of habitat or the temporary displacement of species during their construction period.
- 9.6.105 Notwithstanding this, these planned developments are unlikely to affect the validity of the baseline information gathered for the Scheme at the year of its construction, as these developments will be implemented in compliance with relevant legislation and policy relating to the protection and conservation of biodiversity.
- 9.6.106 It is not possible to accurately predict the baseline for 2023; however, it is anticipated that urban pressures associated with an increased population may result in the expansion of areas of the built environment beyond the Order Limits.
- 9.6.107 It is acknowledged that climate change can lead to changes in the distribution and abundance of some ecological features at the local level; however, any such changes are likely to occur over a long period of time. Accordingly, it is considered unlikely that there would be any significant changes to ecological features by 2023 as a result of climate change.
- 9.6.108 Should there be any large-scale changes in agriculture policies and practices by 2023, these may result in changes to the land use within and surrounding the Order Limits, which may result in some reduction in the extent of the agricultural land. Notwithstanding this, any such changes are unlikely to alter the importance of the biodiversity features recorded in 2017/2018, given that planning policy will likely continue to minimise the loss of biodiversity features and seek no net loss.
- 9.6.109 Chapter 16 Assessment of cumulative effects presents details of the future planned developments that may influence the future baseline conditions, the effects of which have been taken account of as part of the assessment of cumulative effects.

9.7 Potential impacts

9.7.1 The introduction of new highways infrastructure and the modification of existing highway components associated with construction and operation of the Scheme could potentially result in the following types of impact and effect:

Construction

9.7.2 Impacts on ecological features during construction of the Scheme are likely to include the following:

- a. habitat loss or gain – direct impacts associated with changes in land use resulting from the Scheme, for example temporary works associated with site clearance, and permanent landtake associated with the installation of drainage infrastructure and earthworks;
- b. fragmentation of populations or habitats – indirect impacts due to the Scheme dividing a habitat, group of related habitats, site or ecological network, or the creation of partial or complete barriers to the movement of species, with a consequent impairment of ecological function;
- c. disturbance – indirect impacts resulting from a change in normal conditions (light, noise, vibration, human activity) that result in individuals or populations of species changing behaviour or range;
- d. habitat degradation – direct or indirect impacts resulting in the reduction in the condition of a habitat and its suitability for some or all of the species it supports, for example changes in chemical water quality or changes in surface flow or groundwater; and
- e. species mortality – direct impacts on species populations associated with mortalities due to construction activities, for example site clearance.

Operation

9.7.3 Impacts on ecological features during the operational phase of the Scheme are likely to include the following:

- a. species mortality – direct impacts on species populations associated with mortalities from collisions with vehicles, and potentially from pollution incidents or management practices;
- b. habitat degradation – indirect impacts associated with the operation of new road lighting and vehicles using new and/or improved sections of road, for example increased light, noise and emissions leading to a reduction of habitat quality on identified ecological features; and
- c. disturbance – indirect impacts arising from changes in human activity, including use of public rights of way that could lead to changes in animal behaviour, for example changes in roosting behaviour or nesting success.

9.8 Design, mitigation and enhancement measures

- 9.8.1 The Scheme has been designed, to avoid and minimise impacts and effects on ecological features through the process of design-development (see Chapter 4 Scheme history and alternatives), and by embedding measures into the design of the Scheme.
- 9.8.2 A number of standard mitigation measures have also been identified that will be implemented by the appointed Contractor, in order to reduce the impacts and effects that construction of the Scheme will have on ecological features.
- 9.8.3 Compensation measures have been included within the design of the Scheme to offset effects on ecological features that cannot be avoided or addressed through the implementation of mitigation measures.
- 9.8.4 Ecological enhancements have also been identified through the design-development process.
- 9.8.5 The Environmental Masterplan for the Scheme, which places all biodiversity mitigation, compensation and enhancement measures within the wider framework of other environmental measures for landscape, visual and drainage, is illustrated on **Figure 8.8 [TR010027/APP/6.2]**.
- 9.8.6 Some of the measures relating to the protection of designated sites, habitats and fauna include details on methods and/or outcomes. These are described in this assessment.

Embedded mitigation measures

Habitat avoidance, creation and replacement

- 9.8.7 The Scheme has been designed so that impacts upon important habitats (comprising woodland, grassland, hedgerow and ponds) are avoided or reduced, where reasonably practicable, through the retention of existing habitat and the creation or replacement of habitat.
- 9.8.8 The development of planting measures as part of the landscape assessment in Chapter 8 Landscape has been informed by the outcomes of the biodiversity assessment, a key objective being to identify measures that, wherever possible, provide a combined function of landscape integration and/or screening, and habitat creation and replacement, to mitigate effects on biodiversity interests.
- 9.8.9 Habitat creation and replacement measures incorporated into the Scheme have accordingly focused on:
- a. the use of planting along sections of the new mainline link road, to minimise the risk of mortality to barn owls from traffic collisions;
 - b. the creation of grassland habitats on earthwork slopes and within severed or redundant land parcels within the Order Limits, to mitigate for the loss of habitat to the Scheme; and

- c. mitigating effects on existing ecological networks and habitats through the planting of hedgerows (12km), trees and scrub (8.09ha), woodland (3.30ha) and grassland (34.86ha) at locations across the Scheme, taking into account the restrictions on introducing woodland and tree planting within Birmingham Airport's safeguarding zone.

- 9.8.10 The locations of the habitat creation and replacement measures are illustrated on the Environmental Masterplan on **Figure 8.8 [TR010027/APP/6.2]**.
- 9.8.11 Much of the new mainline link road will be positioned within an earthwork cutting which will help to contain operational road noise and reduce indirect effects associated with the degradation of habitats adjacent to the road corridor.
- 9.8.12 The design of the Scheme includes earthwork slopes that are predominantly of 1 in 3 gradient. A narrower footprint has been created by steepening slopes to reduce the total area of permanent landtake required to minimise habitat loss.
- 9.8.13 The extent of landtake associated with M42 Junction 5A and Solihull Road overbridge has been minimised as far as possible within acceptable design and safety limits, to reduce encroachment into Aspbury's Copse ancient woodland.
- 9.8.14 As described in Chapter 3 The project, lighting of new and improved sections of roads within the Scheme have been confined to locations where road safety is a priority, in order to minimise the potential for light spill into adjacent habitats.

Habitat translocation

- 9.8.15 Impacts upon the most important habitats within the Order Limits will be addressed through translocation techniques, the strategies for which will be based on best practice [REF 9-62; REF 9-63] and have been agreed through consultation with Natural England (see Appendix 9.17 [TR010027/APP/6.3]).
- 9.8.16 The following receptor areas for translocated habitats have been located such that they form an integral part of the green infrastructure, thereby maintaining connectivity with similar habitats and the wider landscape. These are illustrated on the Environmental Masterplan on **Figure 8.8 [TR010027/APP/6.2]**.
- 9.8.17 A soil receptor site to mitigate the loss of grassland from Castle Hill Farm Meadows LWS has been identified to maintain connectivity with the retained habitats of the site. The receptor site will form part of a larger area of grassland creation that will lie adjacent to the notable grassland of Bickenhill Meadows SSSI and the highway soft estate. The strategy for grassland translocation at Castle Hill Farm Meadows LWS will be based on best practice [REF 9-62];[REF 9-63]. The key points of the approach are summarised below, the final details of which will be informed by a soil survey of donor and receptor sites prior to construction:
 - a. the translocation will be completed under the supervision of an appropriately qualified Ecological Clerk of Works (ECoW);
 - b. every effort will be made to ensure the translocation will only take place during the autumn, but if this is not possible then it will be completed in early spring and will avoid periods when ground conditions are unsuitable, i.e. too wet and/or frosty and/ or during extreme weather conditions;

- c. the full extent of the donor grassland and receptor sites will be identified and marked out prior to the translocation of soils, with fencing and signage used to protect the area as appropriate;
- d. controlled access routes and low ground-pressure vehicles will be used to avoid unnecessary compaction of soils;
- e. the translocation will involve only the soil A-horizon from the donor site to a depth of up to 40cm as determined by the on-site conditions;
- f. there will be no storage of any soils prior to use; translocation of soils will be undertaken in the same 24 hour period;
- g. the laying of soils will be undertaken in strips the working width of an excavator; no machinery will run on the re-laid soils; and
- h. the laying of soils will be arranged as far as it practicable in a manner that replicates the existing topography and aspect of the donor site.

9.8.18 The loss of hedgerows that are of County importance, and for which there is evidence that they have been established for a long period of time (hedgerows H35 and H42 – see Section 9.9), will be mitigated through their translocation into the retained habitats within the Order Limits. Any sections of these hedgerows that cannot be retained and translocated as a consequence of construction will be replaced or gaps filled where necessary. The approach to hedgerow translocation has been developed to optimise connectivity with retained hedgerows or other habitats, such as woodland and ponds.

9.8.19 Soil translocation will also be implemented as part of measures to compensate the effects of the Scheme on the ancient woodland of Aspbury's Copse pLWS; these are discussed separately as part of the compensation measures within this section of the chapter.

Drainage

9.8.20 The drainage strategy for the Scheme (see Appendix 14.5 [TR010027/APP/6.3]) has been developed to manage surface water runoff in accordance with current highway design standards. The strategy includes treatment measures to mitigate pollution to likely higher standards than exist at present, which will assist in mitigating any effects on aquatic and riparian species and habitats.

9.8.21 Due to the potential risk of large waterbodies attracting birds within Birmingham Airport's safeguarding zone, the drainage strategy for the Scheme has avoided introducing large bodies of open water close to the airport to minimise the potential for bird strike. Alternative measures comprising reed beds and swales have been incorporated into the design of the Scheme to match habitats found in the local area, for example the grassland habitats of Bickenhill Meadows SSSI and Castle Hill Farm Meadows LWS. The design of these wetland features has been developed with the objective of supporting a range of aquatic and inundation communities, in addition to their primary function of holding and treating road runoff.

Bickenhill Meadows SSSI

- 9.8.22 The horizontal alignment of the new mainline link road has been moved as far to the east of Bickenhill Meadows SSSI (NW unit) during the design-development process, to maximise the distance from this unit, which is 100m from the new mainline link road at its closest point.
- 9.8.23 Hydrological investigations have been undertaken within the NW and SE units of the SSSI, as it was identified during the assessment and design process that construction and operation of the new mainline link road could alter local hydrology, which may support the wet grassland communities within the SSSI.
- 9.8.24 A combination of ground investigations, site observations and dipwell monitoring have been undertaken to establish the importance that direct rainfall, surface water runoff and groundwater flows have in maintaining the designated grasslands within the NW and SE units.
- 9.8.25 Based on the outcomes of these investigations, and following the development of a conceptual model to understand how each unit functions and how their grassland communities are maintained, it has been concluded that grassland communities are dependent upon surface water (rather than groundwater) and that around one fifth of the surface water catchment to the west of the new mainline link road will be lost.
- 9.8.26 As this loss of catchment could have consequences for the hydrology of the SE unit, a precautionary approach has been adopted to ensure the long term protection of the grassland communities within the SSSI.
- 9.8.27 A pumped mitigation solution has been developed to mitigate for the loss of surface water catchment at Shadowbrook Meadows SE unit. The design principles of the pumped solution consist of a collection drain on the western slope of the new mainline link road cutting to intercept surface water flows that would otherwise have drained towards the SSSI. The collection drain would discharge to a sealed collection sump, from where water would be pumped and/or captured from an alternative water source(s) to an appropriate reed bed/ditch feature in the vicinity of Shadowbrook Meadows SE unit. This feature would act as a recharge trench, from which water would drain through to the sand, gravel and clay deposits in the upper layers of the substrata within the SSSI. The above design principle has been developed in consultation with and agreed in principle with Natural England.
- 9.8.28 Highways England will continue to refine the mitigation solution using: data obtained from the ongoing dipwell monitoring; and information gathered from further analysis of the local topography and existing water sources. These refinements will seek to identify a sustainable drainage mechanism to mitigate the effects of the Scheme on Bickenhill Meadows SSSI. Highways England will seek to agree any refinements to the mitigation approach with Natural England prior to commencement of the Scheme.

- 9.8.29 The dipwell monitoring is currently being undertaken on a monthly basis and will continue for a period of two years post-submission of the DCO application, in order to record water table levels, the outcomes of which will be shared with Natural England.
- 9.8.30 Further monitoring will be undertaken at both units of the SSSI during construction and the first five operational years of the Scheme. This will include hydrological and vegetation monitoring to determine the success of the mitigation solution, which will be evaluated by the flow of water to the SSSI and the extent of the dependent wet grassland habitats, the objective being to maintain the conservation status of the interest features of the SSSI.

Protected species

- 9.8.31 The following measures have been incorporated into the design of the Scheme to mitigate impacts and effects on protected species, some of which have a direct relationship to the standard mitigation measures for protected species that will be implemented prior to, or during construction. The locations of these measures for protected species are illustrated on the Environmental Masterplan on **Figure 8.8 [TR010027/APP/6.2]**.
- 9.8.32 Mammal tunnels (and associated guide fencing) will be installed at the northern and southern ends of the new mainline link road to aid the safe crossing of the road by badgers and other animals, and to mitigate the risks of increased mortality of wildlife once the road becomes operational and used by traffic.
- 9.8.33 Bat boxes will be sited on retained trees to provide alternative roosting opportunities for the local bat population, and if required (for confirmed high status roosts only), like-for-like roost replacement will be provided.
- 9.8.34 Two receptor sites have been identified for the translocation of GCN that are in close proximity to the GCN ponds, and within which planting, log piles and hibernacula will be used to mitigate for terrestrial habitat lost elsewhere to the Scheme.
- 9.8.35 Breeding and wintering habitat for birds, currently provided by hedgerows, scrub and grassland, will be lost to the Scheme. This loss will be mitigated through the habitat creation and replacement measures, which comprise hedgerows, woodland, scrub and grassland habitat that have been incorporated into the design of the Scheme.
- 9.8.36 Mitigation for terrestrial invertebrates in relation to the loss of woodland comprises a combination of the establishment of new woodland and the retention of deadwood habitat.

Standard mitigation measures

- 9.8.37 The Outline Environmental Management Plan (OEMP) **[TR010027/APP/6.11]** details the measures that will be undertaken during construction of the Scheme to mitigate construction-related effects on biodiversity, the implementation of which will avoid significant construction effects on important biodiversity features associated with dust deposition, air pollution, pollution incidents, water quality, light, noise and vibration.

- 9.8.38 Pre-construction surveys will be undertaken to validate and, where necessary, update the baseline survey findings, the purpose being to obtain the most current and up to date information to avoid impacts on protected species during the construction phase, and to update information required for protected species licencing. These will include, but not be limited to, surveys for: a habitat assessment; bats; GCN; badger, otter, and water vole.
- 9.8.39 Pre-construction surveys will also be undertaken to confirm the location of all invasive species, the findings of which will inform the implementation of measures to prevent their spread in the wild (for example the use of stand-offs, the correct removal and disposal of species, and the washing down of equipment and vehicles in designated locations).
- 9.8.40 To mitigate construction-related impacts and effects on protected species, outline licence applications are included with Appendix 9.4 [TR010027/APP/6.3] [CONFIDENTIAL] (badgers), Appendix 9.18 [TR010027/APP/6.3] (bats), and Appendix 9.19 [TR010027/APP/6.3] (GCN). These licence applications include measures to permanently exclude badgers from construction working areas outside of the badger breeding season. These measures will be updated, as necessary, to take account of the findings of the pre-construction surveys.
- 9.8.41 The following measures will be implemented during construction of the Scheme to protect retained vegetation, designated sites, protected species and other areas of biodiversity value from disturbance, damage and accidental pollution:
- a. the development and implementation of environmental constraints plans and construction working methods;
 - b. the retention of all mature trees and boundary features within the Order Limits that are outside the limits of the permanent works Figure 8.4 TR010027/APP/6.2] and Figure 9.17B in Appendix 9.1 of the Environmental Statement [TR010027/APP/6.3], except where loss is required for construction of the Scheme, including temporary works;
 - c. the use of fencing, where necessary, to prevent access to retained important habitat, protect habitat, avoid accidental damage, and avoid species mortality (including areas to which species have been temporarily displaced);
 - d. the implementation of the protective measures for existing vegetation contained within BS5837:2012 [REF 9-64];
 - e. not locating construction compounds and access tracks within woodland, grassland and existing water habitats as identified on Figure 8.8 [TR010027/APP/6.2];
 - f. undertaking works near watercourses (including the River Blythe SSSI, Hollywell Brook pLWS, Kingshurst Brook pLWS, Shadow Brook and its tributaries) in accordance with Construction Industry Research and Information Association (CIRIA) guidance documents C532 [REF 9-65], C650 [REF 9-66], and C648 [REF-67];

- g. designing and positioning construction lighting to minimise light spill onto adjacent habitats, including where there are potential roosts and important foraging or commuting habitat that is regularly used by the local bat population;
- h. the supervision of construction works by an ECoW or a suitably qualified person, where these have the potential to impact on protected species, designated sites or other important ecological features, the ECoW will also ensure that all standard measures and methods detailed within the appointed Contractor's Construction Environmental Management Plan, including monitoring surveys, are adhered to;
- i. to implement measures to avoid injury or mortality of animals where possible within construction working areas, for example by excluding them from such areas and preventing them being trapped in excavations;
- j. avoiding disturbance to breeding birds by not undertaking vegetation clearance and structure demolitions during the bird breeding season (March 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 the ECoW, with checks regularly carried prior to and during construction to identify any active nests of Schedule 1 [REF 9-5] bird species that may be at risk of disturbance;
- k. deterring birds from nesting in construction working areas, where appropriate, through either physical means to prevent establishment of nests (such as prior coppicing or pruning of vegetation) or other legal means of disturbance (such as the regular ploughing of soils or falconry). These measures will be implemented under the advice and supervision of a suitably experienced ecologist, and will not be used where there is considered to be a risk of disturbance to the active nests of Schedule 1 [REF 9-5] bird species;
- l. the communication of the requirements of the protected species licences, and the associated working practices to construction staff; and
- m. the maintenance of wildlife dispersal corridors during construction (for example mammal tunnels, planting, retained habitat and dark corridors around the boundaries of the Scheme).

Biodiversity Management Plan

- 9.8.42 A detailed Biodiversity Management Plan (BMP) will be produced as part of the Construction Environmental Management Plan for the Scheme, the purpose of which will be to provide management prescriptions aimed at ensuring the Scheme delivers biodiversity benefits over the long term.

- 9.8.43 The BMP will focus on the conservation-led management of retained semi-natural habitats, for example the woodland (including Aspbury's Copse pLWS) and hedgerows, and also any newly created habitats (for example woodland, hedgerows, grassland and wetland habitats). The BMP will include monitoring measures aimed at reviewing the successful establishment of habitats and the use of mitigation measures by fauna, for example, mammal tunnels. The results of monitoring will be used to refine the prescriptions of the BMP.
- 9.8.44 The appointed Contractor will be responsible for undertaking the management of habitats and other features within the contract period, in accordance with the BMP, after which the longer term maintenance and management responsibilities will transfer to Highways England.

Compensation measures

- 9.8.45 Measures have been identified to compensate for the loss of ancient woodland soils (and associated seed bank) and woodland within Aspbury's Copse that will result from the introduction of M42 Junction 5A and its associated slip roads.
- 9.8.46 The Order Limits include land immediately south of the eastern parcel of ancient woodland at Aspbury's Copse, which has been identified as a receptor area to accommodate the following compensation measures:
- a. ancient woodland soils (and associated seed bank), coppice stools, saplings and deadwood from Aspbury's Copse will be translocated into the identified woodland receptor site; and
 - b. new planting in and around the receptor area to a coverage greater in size than that lost to the Scheme (at a minimum replacement ratio of 3:1), the objectives being to increase woodland coverage and maintain and improve habitat connectivity.
- 9.8.47 The location of the land identified for these compensation measures is illustrated on the Environmental Masterplan on **Figure 8.8 [TR010027/APP/6.2]**.
- 9.8.48 The key points of the approach to soils translocation that has been agreed with Natural England is presented below, the final details of which will be informed by a soil survey of donor and receptor sites:
- a. the translocation will be completed under the supervision of an appropriately qualified ECoW;
 - b. the translocation will only take place during the autumn/winter (September to early March, inclusive) and will avoid periods when ground conditions are unsuitable, i.e. when ground conditions are considered to be too wet and/or during extreme weather conditions;
 - c. the full extent of the donor woodland and receptor sites will be identified and marked out from the outset, with fencing and signage used to protect the area as appropriate;
 - d. coppice stools, saplings and deadwood will be retained and translocated with the soils;

- e. controlled access routes and low ground-pressure vehicles should be used to avoid unnecessary compaction of soils;
- f. there will be no storage of soil and translocation undertaken in the same 24 hour period; and
- g. subsequently the receptor site and surrounding area will be planted with native woodland species to achieve a minimum replacement ratio of 3:1 and managed over the long term.

9.8.49 The translocation of deadwood will also serve to mitigate the loss of notable fungi and lichens from within Aspbury's Copse, and will include retaining a varied range of both standing and fallen deadwood from different areas of the woodland, for example from the edge and within the interior of the woodland.

Enhancement measures

9.8.50 The scope to construct a number of habitat types that typically serve as enhancement measures on highway projects has been constrained by the need to manage the risk of bird strike at Birmingham Airport.

9.8.51 Notwithstanding these constraints, a number of enhancement measures have been incorporated into the design of the Scheme that will not attract the aggregation and/or movement of large birds across or along aircraft flightpaths. These principally focus on the creation of new grassland and scrub habitats within the Order Limits, and comprise parcels of land that will be developed and managed in perpetuity to fulfil the objective of improving linkages to retained habitats and other features in the local area, for example grassland, hedgerows, ditches and woodland.

9.8.52 Other enhancement measures incorporated into the design of the Scheme comprise:

- a. the creation of deadwood areas within selected areas of retained habitat, for example within areas of retained woodland and scrub, and at the base of planted hedgerows. This will provide habitat enhancement for a variety of fauna including invertebrates and amphibians;
- b. the establishment of a network of habitats associated with the sustainable drainage system, including ephemeral wetland features, reed bed and damp grasslands. These will provide additional benefits for a number of fauna, including invertebrates, birds and bats;
- c. the installation of bird nesting boxes on selected retained trees within the Order Limits, suitable for a range of species; and
- d. the installation of bat boxes (additional to those required for mitigation) on selected retained trees that have bat roost potential.

9.8.53 Further enhancement opportunities will be sought in the period up to construction.

Biodiversity offsetting measures

- 9.8.54 As part of the design-development process, the total habitat loss of the Scheme was identified to assess the extent to which the mitigation and compensation measures incorporated into the design of the Scheme would offset this loss.
- 9.8.55 This considered habitat losses through construction of the Scheme within the Order Limits, and the effects of temporary landtake within habitats (for instance land used for construction that will subsequently be restored to its former use upon completion of the works).
- 9.8.56 Other factors considered when determining how mitigation and compensation measures would offset habitat loss included existing and proposed habitat condition, the distinctiveness of each habitat type and also the difficulty of habitat creation.
- 9.8.57 This led to the identification of potential improvements over and above those illustrated on the Environmental Masterplan on **Figure 8.8 [TR010027/APP/6.2]** which, if implemented either through the provisions of the DCO or via third party agreements (as described in Chapter 5 EIA methodology and consultation), will contribute to the aspiration of achieving no net loss in biodiversity.
- 9.8.58 These potential improvements include bringing existing habitats into more favourable management, and have been identified in line with the aspirations of NPSNN [REF 9-14] and Highways England's company licence obligations [REF 9-68].
- 9.8.59 Subject to securing the land required to implement these improvements, there will be a commitment to implementing these measures and managing these areas of habitat in the long term.

9.9 Assessment of likely significant effects

- 9.9.1 The prediction of impacts and the assessment of effects has taken account of the embedded and standard mitigation measures and the compensation measures identified within Section 9.8, but does not factor in the contribution that the enhancement measures and biodiversity offsetting measures would have in providing ecological benefits (as described in Chapter 5 EIA methodology and consultation).
- 9.9.2 Impacts and effects on biodiversity are reported for both the construction and operational phases of the Scheme, and are presented first under the headings of designated sites (international, national and other), then habitats, and finally species. The effects of all of the impacts are considered individually and then collectively for each of the biodiversity features assessed.

Construction

Designated sites of international importance

- 9.9.3 Details regarding the relationship between the Scheme and designated sites of international importance are provided in the Habitats Regulations Assessment: No Significant Effects Report [**TR010027/APP/6.8**].

9.9.4 Due to the distance separating the Scheme from the identified designated sites of international importance, the assessment has concluded that there will be no impact pathways during the construction phase. Natural England have confirmed that their agreement with this conclusion (see Appendix 9.17 [TR010027/APP/6.3]). Accordingly, there is considered to be a magnitude of impact of no change arising from construction of the Scheme upon these sites, and therefore a neutral effect applies.

Designated sites of national importance

Bickenhill Meadows SSSI

9.9.5 There would be no direct loss of land within Bickenhill Meadows SSSI as a result of Scheme construction. The assessment has identified that construction of the new mainline link road may result in habitat degradation of Bickenhill Meadows SSSI.

9.9.6 **Habitat degradation.** There is the potential for indirect impacts from changes in the water regime at the SSSI where the new mainline link road will pass between the two separate units of the SSSI in a cutting (up to 10m deep). The two pathways for impact on the hydrological regime of the SSSI are reduction of the surface runoff into the site and reduction of sub-surface flow of groundwater into the SSSI. Detailed hydrological investigations have provided information on the geology and groundwater, as well as installation of boreholes for the ongoing monitoring of seasonal variations in water within the units. Conceptual models of the hydrological regime have been developed for each unit of the SSSI which illustrate seasonal changes, the full details of which are presented within Appendix 14.2 [TR010027/APP/6.3].

9.9.7 The NW unit comprises 2.53ha within two fields with a central stream. The SE unit second comprises 3.14ha within three fields. There is also another adjacent field, not within the SSSI, which is also part of Shadowbrook Meadow Nature Reserve. The unimproved grassland within the fields of the SSSI is a mosaic of two main types of vegetation:

- a. NVC community MG5 crested dog's-tail *Cynosurus cristatus* – black knapweed *Centaurea nigra* grassland, typical of unimproved, grazed hay-meadows; and
- b. MG4 meadow foxtail *Alopecurus pratensis* – greater burnet *Sanguisorba officinalis* grassland, found on floodplain meadow, or other low-lying sites which are seasonally wet, but dry out during spring.

9.9.8 These two types of vegetation occur as a mosaic, in response to small-scale variations in topography and drainage. These are determined by the slope of the sites, small seasonal watercourses, the remains of old ridges and furrows, compaction from previous disturbance and variations in the soil and underlying substrate. The MG4 community is sensitive to changes in water regime. If it becomes waterlogged for longer it is likely to change towards a fen meadow community, with an increase in rushes (*Juncus* spp.), sedges (*Carex* spp.) and tall herbs, for example as meadowsweet (*Filipendula ulmaria*), or with increase in

tussocky grasses, for example tufted hair-grass (*Deschampsia cespitosa*). The direction of these changes may be dependent on the clay content of soil [REF 9-69]. By contrast, if the community does not become sufficiently wet in the winter, or if the average soil water level is more than about 70cm below the surface in the summer, and so does not provide damp enough conditions in the root zone, it will progressively change to another community more tolerant of dry conditions [REF 9-69]. The new community will depend on the conditions and the proximity of other types of grassland. In the mosaic at this site it will be likely to shift towards MG5, with reduction or loss of the characteristic MG4 species, for example greater burnet.

- 9.9.9 The NW unit is a small, roughly square grassland area divided approximately in half by a tributary of Low Brook, which flows from south to north, with the fields sloping down towards the watercourse on both sides. The investigations found that part of the catchment for this tributary will be cut off by the construction of the Scheme. The study of the underlying geology in the area between the Scheme cutting and the SSSI found that the cutting will mainly be through clay, with only a small pocket of glacial sand and gravel from which there could be movement of groundwater (see Chapter 10 Geology and soils). With the impermeable Mercia Mudstone lying close to the surface within the site, the investigations concluded that the hydrological regime was mainly dependent on rainfall and impeded drainage within the site, rather than groundwater flow. The Scheme will reduce the available area for surface drainage by about 5% by area, but this will have a negligible magnitude of impact on the retention of water within the SSSI, being much less than the natural variations that occur due to rainfall. Consequently changes in vegetation from the hydrological regime are expected to result in a negligible adverse impact. The effect of the Scheme on the NW SSSI is therefore expected to be slight adverse.
- 9.9.10 At the two fields within the SE unit that lie east of a small watercourse (an unnamed tributary of Shadow Brook), the ground rises and the grassland is dry, MG5 community. To the west and in the lowest-lying areas, the micro-topography gives rise to diverse ecological communities. The lower-lying areas are regularly saturated and support MG4 community, whereas the higher areas are drier and MG5 neutral grassland species are more abundant.
- 9.9.11 The hydrological investigation found that the SE SSSI unit had more permeable soil than the north-western one, with sand and gravel overlying sandy clay. Rainfall permeates into these superficial layers, but only as far as the underlying Mercia Mudstone, which leads to movement of water in the permeable layers above the Mudstone. The investigation found no evidence that the cutting of the new mainline link road will intercept any significant areas of sand and gravel that could provide an aquifer and support the hydrology of the SE SSSI unit. As the new mainline link road will cut through the Mudstone, it will effectively be isolated from the SSSI and will result in no impact on groundwater within the site.

- 9.9.12 The cutting will, however, cut off approximately 21% of the surface water catchment which supplies the SE unit. That area currently drains to a ditch in an arable field and is presumed to pass under Shadowbrook Lane, although the culvert may be blocked (evidenced by an apparent build-up of silt adjacent to each side of the road, see Appendix 14.2 [TR010027/APP/6.3]). Notwithstanding this, it is likely that all of the drainage from the severed area of catchment does make its way into the SSSI, and a reduction of catchment area will alter the water regime in the site. As the existing ditches on both units of the SSSI drain surplus water off the site, some uncertainty exists as to the minimum amount of surface water required to sustain the existing mosaic. There will still be seasonal variations in water regime and significant year to year variations, but on average the SSSI could dry out earlier in the year than it will without the Scheme. In some of the areas that currently support MG4 the soil water level could fall too low to support the community in its present form. Over a period of several years the mosaic of low-lying wet areas would tend to reduce, with the area of MG4 community decreasing within the SSSI unit and contracting into only the wettest parts. The MG5 community would not be expected to be affected, except perhaps to increase, but the MG4 community will be expected to reduce.
- 9.9.13 The MG4 grassland is rare nationally. Unimproved neutral grassland of all kinds in Warwickshire, Coventry and Solihull (mostly MG5) was estimated as 186ha for the Habitat Biodiversity Audit in total in 2012, and only 73.4ha was present in the SSSIs in the region [REF 9-41].
- 9.9.14 To mitigate the potential loss of grassland, options for mitigation have been identified (see Appendix 14.2 [TR010027/APP/6.3]) and consulted upon with Natural England. The preferred option has been incorporated into the Scheme as embedded mitigation to maintain the existing flow into the SSSI.
- 9.9.15 The distribution of sub-surface flow will be slightly different compared to existing conditions, with recharge occurring above the level of the existing watercourse. Damp sub-surface conditions will be likely to persist a little longer seasonally than they would do otherwise in the western side of the SSSI. This will tend to favour MG4 rather than the drier MG5, so there will be likely to be small variations in the vegetation, although this is expected to have some benefits compared to the existing conditions in the SSSI. The patch-scale change will depend on soils and micro-topography and may not be detectable against the natural background of change due to year to year climatic variations and the effects of management.
- 9.9.16 The assessment has concluded that there will be a negligible adverse magnitude of impact on the SSSI with the identified mitigation in place, resulting in a Slight adverse effect during the construction period.

River Blythe SSSI

- 9.9.17 River Blythe SSSI is a botanically diverse lowland river that passes beneath the M42 motorway within the southern extent of the Order Limits.
- 9.9.18 There will be no works outside the highway boundary adjacent to the SSSI and no loss of habitat. The nearest construction works will be approximately 400m to the north of where the SSSI passes underneath the M42 motorway.

9.9.19 The assessment has concluded that there will be a magnitude of impact of no change, leading to a neutral effect on the SSSI.

Coleshill & Bannerly Pools SSSI

9.9.20 Coleshill & Bannerly Pools SSSI comprises the only valley mire system in Warwickshire, and is located in three separate units south and east of M42 Junction 7. The SSSI has a combined area of 37.6ha and consists of a series of pools, together with the intervening area known as the Bogs.

9.9.21 There will be no losses of habitat from any part of the SSSI; however, as this is a sensitive wetland habitat there is a risk of indirect hydrological impacts.

9.9.22 The northern and eastern units are remote from the Scheme (located 475m north east and 1km east, respectively) and there are no pathways for hydrological impacts. The western unit is immediately adjacent to the M42 motorway and the northernmost extents of the Order Limits.

9.9.23 Chapter 14 Road drainage and the water environment identifies that there are considered to be no hydrological connections to this SSSI from the highway drainage, and that the Scheme will therefore not change the existing hydrological regime.

9.9.24 The SSSI will not be at risk from other indirect construction impacts, for example surface runoff of soils, as these will be mitigated through the application of standard mitigation measures.

9.9.25 Although the western edge of the SSSI is located adjacent to the M42 motorway, the Scheme will result in a magnitude of impact of no change, leading to a neutral effect on the SSSI during the construction period.

Non-statutory designated sites

9.9.26 The predicted impacts and effects upon non-statutory sites are described below in relation to either habitat loss or habitat degradation.

9.9.27 **Habitat Loss.** The assessment has identified that construction of the Scheme will result in direct loss of habitat from the following non-statutory sites of nature conservation importance:

Aspbury's Copse pLWS

9.9.28 Construction of M42 Junction 5A and its associated slip roads will result in the direct and unavoidable loss of habitat from the ancient woodland of Aspbury's Copse pLWS, which comprises two blocks of woodland historically severed by the M42 motorway.

9.9.29 As noted in Section 9.6, the designated boundary of ancient woodland at Aspbury's Copse has recently been amended by Natural England [REF 9-33]. This amendment has, however, resulted in the ancient woodland resource boundary differing to the Aspbury's Copse pLWS boundary (which remains contiguous with the original boundary of the ancient woodland resource, prior to its amendment). Therefore within Aspbury's Copse pLWS the total area of ancient woodland resource is less than the area covered by the pLWS designation.

- 9.9.30 There will be the loss of woodland from one side of each woodland block of Aspbury's Copse. At its widest point, this strip will be 16m wide on the eastern block and 30m wide on the western block. This loss totals 0.46ha of woodland that will be permanently lost from the ancient woodland resource of Aspbury's Copse pLWS, and is equivalent to 20.2% of the current area (2.27ha) of this ancient replanted woodland habitat.
- 9.9.31 An additional 0.53ha of woodland within Aspbury's Copse pLWS that does not represent ancient woodland habitat will also be lost as a result of the Scheme, and is equivalent to 77.9% of the current area (0.63ha) of this woodland. Each area is characterised by plantation woodland and/or species-poor groundflora (see Appendix 9.2 [TR010027/APP/6.3]).
- 9.9.32 The total loss of woodland within Aspbury's Copse pLWS would therefore be 0.99ha.
- 9.9.33 The loss of the 0.53ha of woodland within Aspbury's Copse pLWS will be mitigated through the establishment of 0.42ha of woodland planting on the embankments of Solihull Road overbridge that will form the redefined edges of Aspbury's Copse pLWS, and an additional 2.53ha of native woodland planted around the M42 Junction 5A roundabouts, which will further extend the overall coverage of woodland habitat in this location.
- 9.9.34 The loss of 0.46ha ancient woodland resource within Aspbury's Copse pLWS will be compensated for separately, as described in the following paragraphs.
- 9.9.35 The NPSNN [REF 9-14] acknowledges ancient woodland to be an irreplaceable habitat because of the long continuity of woodland cover, which means that even woodland sites which have been replanted are important as part of the resource. Its loss cannot be fully compensated by new planting. Many of the species of ancient woodland have poor ability to colonise from areas of existing ancient woodland and into separate new habitats, and this may even be the case after the periods of decades that are required for planted trees to develop on a new site.
- 9.9.36 In addition to the direct loss of ancient woodland habitat, severance of woodland can have indirect effects on the quality of the habitat of adjacent retained woodland. This may occur due to 'edge effects'. The new woodland edges will be exposed to more light, reduced humidity and greater exposure to increased nutrient deposition from adjacent exposed soils. In combination such conditions favour the growth of more vigorous species at the expense of those which are more dependent on the more stable conditions within the woodland. In small woodland sites, reducing the woodland area may reduce the ability of the site to support viable populations.

- 9.9.37 Although the affected area falls within the designated boundary of the ancient woodland, botanical survey (see Appendix 9.2 [TR010027/APP/6.3]) has demonstrated that the affected habitats are dominated by a species-poor ground flora and canopy, with the coverage of ancient woodland ground-flora mostly located outside the affected area. As the woodland was previously severed by the M42 motorway, it is likely that the flora now present adjacent to the motorway corridor is what can be expected to develop in the new edge zone of the retained woodland, i.e. if the original flora and soils were similar. The likely indirect effect of the woodland loss is that an altered edge effect and new species-poor zone will gradually develop within a similar zone in the retained woodland.
- 9.9.38 Notwithstanding this, it is recognised that the woodland diversity is closely related to overall habitat diversity rather than total area [REF 9-70]. Aspbury's Copse pLWS has a reasonably uniform habitat structure and botanical diversity is limited throughout, although some additional diversity is provided by the edge habitat, a shallow ditch (to the west only) and the accumulated deadwood. Habitat loss will remove some of the existing woodland edge habitat, and as a result of the altered edge effect there is likely to be a reduction in the quality of ground flora within an equivalent width to that lost to construction, extending from the new woodland edge towards the central woodland area. However, the remaining features are largely associated with the woodland interior that is expected to remain unaffected.
- 9.9.39 The losses of ancient woodland from Aspbury's Copse pLWS represent a reduction in the overall extent of this irreplaceable habitat resulting in a magnitude of impact of moderate adverse, leading to a moderate adverse effect (significant), because whilst it is possible to replace woodland vegetation, it not possible to replace all historic and biodiversity aspects which contribute to the status of an ancient woodland. The total resource of ancient woodlands in Warwickshire is 4,236ha (in areas more than 2ha in size), of which 1,797ha is classed as Plantation on Ancient Woodland Sites [REF 9-33]. The remaining blocks of ancient woodland resource within Aspbury's Copse (0.80ha west and 1.01ha east) are likely to be large enough to retain the existing suite of botanical species in the woodland and hence the ecological integrity of the woodland is expected to be maintained despite the reduction of area.
- 9.9.40 As described in Section 9.8, the Scheme includes measures to partly compensate for the unavoidable loss of habitat through the translocation of ancient woodland soils to a receptor site, together with tree stumps and other deadwood material. The donor materials will be translocated to a location with the Order Limits immediately south of Aspbury's Copse pLWS (east block), as illustrated on the Environmental Masterplan on **Figure 8.8** [TR010027/APP/6.2].

- 9.9.41 Monitoring of case studies indicates that many species of woodland flora establish well after translocation of woodland soils, especially where coppice stools are translocated which assists in keeping the soil profile intact [REF 9-71; REF 9-72]. Uncertainty of the success of woodland translocation is recognised [REF 9-62; REF 9-63; REF 9-72], because there is limited information available about the success of translocation of fungi, soil fauna and specialist woodland invertebrates. There may also be issues with soil fertility, drainage, dominance by some species, for example bramble, and uncertainty over the short to long term rates of establishment and spread of the flora. There is high confidence, however, that even with these factors, results in new plantations with translocated woodland soils are much better than those on agricultural soils.
- 9.9.42 The receptor area will add approximately 1.9ha to the eastern block of Aspbury's Copse, achieving an overall replacement ratio for the ancient woodland habitat of no less than 3:1. As the total area of ancient woodland lost to the Scheme is 0.46 ha, not all of this area will receive woodland soils. Nonetheless, it will enlarge the eastern block to a similar size to that prior to the original severance of the woodland by the M42 motorway. The retained ancient woodland and the translocated woodland soils will serve as a source of woodland flora for the new woodland, albeit in the long term. Conservation-led management of the existing and created woodland will seek to develop and improve upon the woodland structure, including an increase in the abundance of standing and fallen deadwood.
- 9.9.43 It is recognised that ancient woodland with its long history and complexity of habitat cannot be replicated, and certainly not within 15 years. Nonetheless, when the compensatory measures incorporated into the Scheme are taken together (comprising minimising loss of ancient woodland, loss of just the edges of a severed site, woodland soil translocation, dead wood translocation, increased area through new planting and improvements in management of retained woodland, the magnitude of impact is predicted to be minor adverse, resulting in an slight adverse effect in the design year in relation to habitat loss within Aspbury's Copse pLWS.

Castle Hill Farm Meadows LWS

- 9.9.44 Castle Hill Farm Meadows LWS represents an extensive area (72ha) of crested dog's tail (*Cynosaurus cristatus*) and back knapweed (*Centaurea nigra*) grassland (MG5), and is recognised as one of the most important grasslands in Warwickshire.
- 9.9.45 Construction of the new mainline link road between M42 Junction 5A and the A45 will result in the unavoidable loss of 1.17ha grassland from Castle Hill Farm Meadows LWS. This loss represents 1.6% of the existing designated area of this non-statutory site. The areas affected are two separate 'spurs' of grassland in field compartments that extend east towards Catherine-de-Barnes Lane from the main, central area of the designated LWS. The northernmost of these areas is being invaded by scrub due to an apparent lack of management.

- 9.9.46 NVC survey of the southern-most area in 2017 indicated that rather than MG5 grassland the habitat was akin to the grass-dominated MG6 community, and this was consistent with the abundance of plants observed in 2018 (see Appendix 9.2 [TR010027/APP/6.3]). Therefore, given the limited amount of landtake from the LWS and the poor quality of habitat at the locations affected, the loss is unlikely to undermine the conservation status of the grassland of the LWS overall. Therefore, the loss 1.17ha from Castle Hill Farm Meadows LWS is considered to represent a magnitude of impact of minor adverse, leading to a slight adverse effect.
- 9.9.47 The areas of Castle Hill Farm Meadows LWS which will be lost to the Scheme are not currently in favourable condition with respect to the primary feature for which the site is designated, namely MG5 grassland. Nonetheless, the LWS grassland has been long-established and the soils will contain a seedbank as well as soil flora and fauna that will not be present in regularly disturbed agricultural soils. Hence, soils from the site have much more value for the establishment of new areas of grassland habitat than nutrient-rich soil from arable land or improved grassland, which will lack the diversity within the meadow soil.
- 9.9.48 As described in Section 9.8, mitigation for the unavoidable loss of grassland habitat from Castle Hill Farm Meadows LWS will be achieved by the translocation of grassland habitat to a pre-prepared grassland receptor within the Order Limits, which has been selected so that connectivity with the wider Castle Hill Farm Meadows LWS is maintained.
- 9.9.49 The use of grassland translocation as a means of mitigation is well accepted [REF 9-62];[REF 9-63]. Over the long term the grassland will be managed in a similar way to a hay meadow, i.e. by mowing and removal of arisings, to avoid build-up of soil fertility and the risk of increased dominance by grasses. Traditionally, hay meadows have been managed with periods of grazing in late summer/autumn and spring. If appropriate grazing cannot be secured within the soft estate, additional mowing and removal will be used to achieve equivalent management. Given the small proportion (i.e. 1.17 ha, which is 1.6% of the total LWS area) of Castle Hill Farm Meadows LWS affected, and the commitment to favourable long term management of the translocated grassland (to be set out in the BMP), it is considered that there will be a negligible adverse magnitude of impact in the design year, which represents a neutral effect in relation to habitat loss.

Hollywell Brook pLWS

- 9.9.50 Hollywell Brook pLWS is a stream and associated grassland, artificial ponds and a small woodland area. The site is of interest because it forms a tributary of the River Blythe SSSI and also due the aquatic and marginal vegetation associated with the pond.

- 9.9.51 Construction of the M42 southbound to A45 eastbound slip road at M42 Junction 6 will result in the loss of a 20m long section of the brook. This loss is no more than 0.5% of the total length of this designated site, and will not affect the brook's connection with the River Blythe SSSI. Given the limited extent affected, the losses are unlikely to undermine the status of its riparian vegetation.
- 9.9.52 Accordingly, the habitat loss is considered unlikely to affect the ecological function of Hollywell Brook pLWS and will therefore result in an adverse impact of negligible magnitude during the construction period, resulting in a neutral effect.
- 9.9.53 **Habitat Degradation.** There is a risk of the degradation of the designated habitats of non-statutory sites as a result of accidental damage of retained habitats, increased dust levels and hydrological change.
- 9.9.54 The risk of the degradation to the retained habitats of all non-statutory sites as a result of accidental damage during construction will be mitigated through the implementation of BS5837:2012 [REF 9-64] and other protective measures as set out in the OEMP [TR010027/APP/6.11]. For example, measures include identifying and protecting retained habitat within and adjacent to the Scheme with appropriate stand-offs for working areas. As such, the magnitude of impact of disturbance from accidental damage to the habitats of all non-statutory sites during the construction period is considered to be negligible adverse, leading to a neutral effect.
- 9.9.55 Measures to control dust during construction, including damping down and wheel washing, will reduce as far as practicable impacts upon sensitive vegetation. Therefore, the magnitude of impact of increased dust during construction upon the sensitive habitats of all non-statutory sites will be negligible adverse, leading to a neutral effect.
- 9.9.56 The MG5 grassland communities known to be present at Castle Hill Farm Meadows LWS are more characteristic of well-drained soils [REF 9-69] and there are unlikely to be any significant hydrological connections between the LWS and the Scheme. Therefore, the magnitude of impact upon Castle Hill Farm Meadows LWS as a result of hydrological change during the construction period will be negligible adverse, leading to a neutral effect.
- 9.9.57 Greens Ward Piece LWS is an area of wet and dry grassland that together with Bickenhill Meadows SSSI makes up Shadow Brook Nature Reserve. There is potential for the wet grassland communities of Greens Ward Piece LWS to be impacted upon during construction by the severance from a significant proportion of its catchment (as described above for Bickenhill Meadows SSSI); however, the mitigation measures adopted for Bickenhill Meadows SSSI will also address the impacts upon Greens Ward Piece LWS. Therefore, the magnitude of impact on this LWS will be negligible adverse, leading to a neutral effect.

9.9.58 Through the application of standard mitigation measures detailed in the OEMP [TR010027/APP/6.11] during construction, potential indirect impacts on water supply or quality at any other non-statutory sites identified in **Table 9.8** associated with accidental pollution or changes in the rate, amount and quality of water supply would be avoided or reduced. The magnitude of impact of pollution or hydrological change upon all other non-statutory sites is negligible, resulting in a neutral effect.

Habitats

9.9.59 The following sections report the construction impacts occurring as a result of the loss of those habitats that are important ecological features (i.e. of at least Local importance) and which lie outside the boundary of designated sites or the land required for the mitigation of impacts upon designated sites (such as receptor sites for translocation).

9.9.60 **Habitat loss and gain.** The construction of the Scheme will result in both losses and gains of habitat that are of at least Local importance. The permanent habitat gains are those classified as habitats created as part of the Highways England soft estate (or other land owned by Highways England). **Table 9.8** provides a summary of all habitat losses and gains within the Order Limits. It does not correspond to the total area of land required for the Scheme because it does not include highway or other built infrastructure.

Table 9.8: Habitat losses and gains

Existing habitat	Habitat loss	Importance	New habitat (see Environmental Masterplan)	Habitat gain (ha)	Net permanent gain (ha)
Mixed woodland, including plantation	2.33	Local	Woodland (plantation)	3.30	+1.03
Scattered trees	0.35	Negligible	n/a	0	-0.35
Scrub	6.01	Local	Scrub	8.09	+2.43
Arable	30.31	Negligible	n/a	0	-30.31
Improved grassland	8.81	Negligible	n/a	0	-8.81
Amenity grassland	0.34	Negligible	n/a	0	-0.34
Ephemeral short-perennial	0.93	Negligible	n/a	0	-0.93
Semi-improved grassland	7.08	Local	Semi-improved grassland	34.86	+27.78
Ponds	0.03	Local	Ponds (drainage)	0.63	+0.60
Buildings and hardstanding	7.22	Negligible	Built environment	17.97	+10.75

- 9.9.61 There will be no loss of any areas of semi-natural woodland that fall outside the boundary of designated sites. The Scheme will result in the loss of 2.33ha of plantation woodland. This loss will be mitigated through the creation of 3.30ha of new native woodland across the Scheme, the locations of which will establish connectivity with other areas of established habitat including woodland, scrub and hedgerows, and will be managed to maximise the woodland's structural diversity. Therefore, given the excess of habitat to be created, once established the woodland will result in a magnitude of impact of negligible adverse, which represents a neutral effect in the design year.
- 9.9.62 The Scheme will result in the loss of 6.01ha of scrub. This loss will be mitigated through the creation of 8.09ha of replacement scrub habitat that will be located to complement the structural diversity of adjacent habitats including woodland, hedgerows and grassland. Given the excess of habitat to be created, once established the scrub will result in a magnitude of impact of negligible adverse, which represents a neutral effect in the design year.
- 9.9.63 The Scheme will result in the loss of 7.08ha of the species-poor, semi-improved grassland, which is a common and widespread habitat type. The losses of this semi-improved grassland will be mitigated through the creation of 34.86ha native grasslands, including on the embankments of the road, as illustrated on the Environmental Masterplan (see **Figure 8.8 [TR010027/APP/6.2]**). These grasslands will be subject to management over the long term as part of the Highways England soft estate, which will seek to maintain a mix of swards and to replicate the benefits of hay meadow management. Therefore, given the excess of habitat to be created, once established the new grassland will result in a magnitude of impact of minor beneficial, which represents a slight beneficial effect in the design year.
- 9.9.64 The Scheme will result in the loss of the ponds 8, 39 and 43 during construction, the locations of which are illustrated on **Figure 9.9** in Appendix 9.9 **[TR010027/APP/6.3]**. These ponds are species-poor and ephemeral, but do form part of a wider 'pondscape' in the surrounding area. Wetland reed bed features incorporated into the design of the Scheme (forming part of the treatment train of the Scheme's sustainable drainage system) will be ephemeral waterbodies, similar to the existing ponds. Given the poor quality of the existing ponds, it is considered the loss of ponds 8, 39 and 43 will be mitigated once the reed beds are established. Therefore, following the establishment of these reed beds the pond loss during construction will result in a magnitude of impact of negligible adverse in the design year, which represents a neutral effect.

- 9.9.65 The Scheme will result in the loss of approximately 4.5km of hedgerows. It is reasonable to anticipate that partial losses from any individual hedgerow may affect its ecological function, such as the hedgerow's ability to support associated flora. Losses from any hedgerows of less than 20m⁵ are considered unlikely to affect the conservation status of these hedgerows and constitute a magnitude of impact during construction of negligible, leading to a neutral effect.
- 9.9.66 Losses from hedgerows that exceed 20m (see **Table 9.9**) (see **Figures 9.3** and **9.17B** in Appendix 9.3 and 9.1 respectively [TR010027/APP/6.2]) can result in adverse effects; however, the losses of all hedgerows that exceed 20m will be mitigated through either the translocation of hedgerows, or the planting and long term management of at least an equivalent length of native, species-rich hedgerow. The translocated hedgerows will be limited to those that are both of County importance for ecological reasons and for which there is evidence that they have been established for a long period of time i.e. H35 that follows the line of a historical road (Gorse Lane) and H42 that lies along a civil parish boundary (see Chapter 7 Cultural heritage). The translocated hedgerows will be moved to receptors sites that fall within the Order Limits. The hedgerows will be managed as part of the Highways England soft estate. Once established, it is reasonable to anticipate that the magnitude of impact resulting from the loss of hedgerows will be negligible adverse, leading to a neutral effect in the design year.

Table 9.9: Hedgerow loss

Extent of hedgerow loss		Important and species-rich hedgerow (County)	Inaccessible (assumed County)	Native hedgerows (Local)
90 – 100% lost		H38	H53, H61, H63, H77	H10, H35, H54, H65, H67, H73, H75, H79, H88, H96, H99, H102, H104, H114, H121, H126, H127
< 90% lost	More than 20m	H20, H40, H45	H60, H78, H84	H3, H5, H11, H17, H18, H23, H28, H29, H32, H42, H81, H89, H94, H98, H120
	Less than 20m	n/a	H62, H93, H122, H123	H4, H6, H30, H83, H86

- 9.9.67 **Habitat Fragmentation.** By affecting the linkages that are formed by hedgerows, both between themselves and with inter-connected habitats, most particularly areas of woodland, the loss of hedgerows has the potential to fragment the wider hedgerow and habitat network. The Scheme will impact some of the species-rich and important hedges that are located north of Solihull Road i.e. H20, H38, H40 and H45. However, when considering the magnitude of any fragmentation impact it is relevant that the interconnectedness of the wider hedgerow network is

⁵ 20m is the distance (or gap) set out within the Hedgerow Regulations 1997 [REF 9-10] to define two separate hedgerows, i.e. two rows of bushes separated by a linear distance of 20m are considered to be separate hedgerows.

already fragmented by the road corridor of Catherine-de-Barnes Lane. The fragmentation impact will be mitigated by ensuring that the replanting of hedgerows is planned to maintain connections between retained hedgerows and habitats. Therefore, it is considered that once hedges are established, the magnitude of impact of fragmentation upon the hedgerow network during construction will be negligible adverse leading to a neutral effect in the design year.

- 9.9.68 **Habitat Degradation.** There is a risk of the degradation of the habitats outside the boundary of designated sites as a result of accidental damage of retained habitats, increased dust levels and hydrological change.
- 9.9.69 The risk of disturbance to all retained habitats as a result of accidental damage during construction will be mitigated through the implementation of measures contained within BS5837:2012 [REF 9-64] and clearly marking the boundaries of working areas including appropriate stand-offs from ecological features. Therefore, the magnitude of impact of disturbance from accidental damage to all retained habitats will be negligible adverse, leading to a neutral effect in the construction period.
- 9.9.70 The implementation of standard mitigation measures relating to the control and management of dust (see Section 9.8) will reduce, as far as practicable, impacts to the sensitive vegetation of retained habitats. Therefore, the magnitude of impact of increased dust during construction upon to all habitats will be negligible adverse, leading to a neutral effect during the construction period.
- 9.9.71 A small area of semi-natural wet woodland habitat that is of Local importance will be surrounded by the Scheme. As this woodland is sited over a 'bowl' of Mercia Mudstone its water supply is likely to be fed by rainwater (see Chapter 14 Road drainage and the water environment). The Scheme will result in slight reduction in the catchment that supplies the woodland with water. This reduction is unlikely to be sufficient to prevent 'recharge' of water to the wet woodland, and is therefore unlikely to adversely affect the nature or extent of this habitat. Therefore, any hydrological magnitude of impact as a result of the Scheme construction is considered to be negligible adverse, leading to a neutral effect during the construction period.
- 9.9.72 Standard mitigation measures (see Section 9.8) applied during construction will avoid potential impacts on retained habitats from any changes in the rate, amount or quality of surface water runoff. Accordingly, the magnitude of impact on retained habitats will be negligible adverse, leading to a neutral effect during the construction period.

Badger

- 9.9.73 Badgers are a widespread species, and the population present is considered to be of Local importance. The detailed impact assessment on badgers is reported in a separate confidential document (see Appendix 9.4 [TR010027/APP/6.3] [CONFIDENTIAL]). In summary, the potential impacts to badgers during construction comprise habitat loss, direct mortality, disturbance and habitat fragmentation.

- 9.9.74 **Habitat Loss.** No main setts will be lost as part of the Scheme. Two Annex/Subsidiary setts and a single Outlier sett will be permanently lost, and a single Subsidiary sett will be temporarily lost. As detailed in the OEMP [TR010027/APP/6.11] all badger sett closures will be completed under a Natural England licence.
- 9.9.75 The Scheme will result in the loss of habitat that is used by the local badger population for foraging and commuting, and is likely to result in the displacement of badgers from the affected areas. However, the vast majority of the territories occupied by local badger clans will be retained and therefore the habitat losses are unlikely to undermine the local conservation status of this species.
- 9.9.76 **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, the standard working practices detailed within the OEMP [TR010027/APP/6.11] and the confidential badger report (see Appendix 9.4 [TR010027/APP/6.3] [CONFIDENTIAL]) will be implemented within proximity to retained setts to prevent injury or disturbance to badgers during construction.
- 9.9.77 **Habitat fragmentation.** Habitat losses during construction will result in the fragmentation of habitat used by local badger clans, limiting access to some of their foraging areas. However, based upon the existing distribution of badger territories it is considered that any fragmentation impact will be localised and unlikely to affect the conservation status of the local badger clans. Measures embedded in the Scheme, including badger tunnels, fencing and strategic planting (see Section 9.8) will ensure that habitat connectivity for badgers is maintained over the long term.
- 9.9.78 Therefore, the magnitude of impact upon the local badger population during the construction period is considered to be negligible adverse, leading to a neutral effect.

Bats

- 9.9.79 The assemblage of bats is considered to be unexceptional and typical of the habitats present, and therefore has been assessed of being of Local importance. The roosts within the Order Limits are used only occasionally by common and widespread species, and have therefore also been assessed as being of no more than Local importance. The potential impacts of construction upon bats relate to habitat loss or gain, disturbance (from noise, vibration and light) and habitat fragmentation.
- 9.9.80 **Habitat loss or gain.** A small, occasionally used brown long-eared bat roost has been identified within building B1, which will be demolished as part of the Scheme. Separate tree roosts used by individual common pipistrelle and soprano pipistrelle bats have also been identified in trees T17, T21 and T242 which will be lost to the Scheme (see **Figure 9.5B** in Appendix 9.5 [TR010027/APP/6.3]).

- 9.9.81 The existing WGAA clubhouse building that was inaccessible to survey may be impacted. Accordingly, a precautionary approach has been adopted in the assessment which allows for the possibility of a 'worst-case scenario' where a high-status (breeding) bat roost is confirmed to be present. Mitigation for a high status roost involves provision of like-for-like replacement and the siting of bat boxes on retained trees or buildings for lower status bat roosts.
- 9.9.82 The mitigation strategy for the loss of confirmed and assumed roosts is detailed as part of a draft Natural England EPS derogation licence presented in Appendix 9.18 [TR010027/APP/6.3], which details the appropriate timing and safe working practices necessary to ensure that the risk to bats is minimised and that suitable alternative roosting sites are provided for bats. These measures are considered sufficient to ensure that the Favourable Conservation Status of local bat populations is maintained.
- 9.9.83 Bats make transitory use of suitable tree roost sites and as such there is a risk that trees supporting features that are suitable for bats, and where no current evidence was found, may become occupied in the future. Therefore, pre-construction surveys will be carried out as best practice prior to felling of any trees with potential to support roosting bats to be lost to construction works. These surveys will consist of an aerial inspection and/or a dawn activity survey in advance of felling. Providing that no bats are present the tree will be section felled by experienced arborists under the supervision of an appropriately licensed bat worker. If bats are confirmed to be present at any time then works in that location will be halted until an appropriate Natural England EPS derogation licence is put in place. These measures will be sufficient to ensure that (should bats be present) the Favourable Conservation Status of local bat population is not altered.
- 9.9.84 Additional roosts (bat boxes) are also proposed within the Order Limits as part of the Scheme's ecological enhancements, which will serve to replace the potential roosting opportunities lost to the Scheme.
- 9.9.85 Following the provision of replacement roosts, including where necessary under Natural England licence, the Scheme will result in a magnitude of impact of negligible adverse, leading to a neutral effect upon roosting bats during the construction period.
- 9.9.86 Overall the bat activity associated with the habitats within the Order Limits was low and typical of the habitats present. In general the Scheme will result in the loss of habitats that are associated with the lower levels of bat activity, in particular to the north and east Catherine-de-Barnes Lane. The Scheme will also result in the loss of some habitats that have higher levels of bat activity, including to the east and west of Catherine-de-Barnes Lane. Habitat losses from Aspbury's Copse pLWS are limited to the area of this woodland that lies adjacent the M42 motorway, which is closer to this busy road corridor and likely to be of lower interest to bats than the more sheltered areas of this woodland. Overall the direct losses from the foraging and commuting habitat that is more regularly used by the local bat population are localised.

- 9.9.87 The Environmental Masterplan illustrated on **Figure 8.8 [TR010027/APP/6.2]** identifies that the Scheme will include the re-establishment of hedgerows, grassland, scrub and wetland (reed beds). In order to make them accessible to bats, these habitats will be linked to the areas of habitat that are known to be used by the local bat population. Therefore, once this replacement habitat has established the magnitude of impact of habitat loss and gain during construction will be negligible adverse in the design year, leading to a neutral effect.
- 9.9.88 **Disturbance.** Activities resulting in increased levels of noise, vibration or light can lead to bats abandoning roosts or displacing them from foraging and commuting habitat. Bats are susceptible to disturbance impacts, particularly during the sensitive hibernation and maternity period. There is no evidence of hibernation or maternity roosts within the Order Limits. Commuting and foraging bats may also be disturbed by increased noise and light levels during the construction period. Standard construction working measures detailed in the OEMP [TR010027/APP/6.11] will reduce any disturbance impacts as a result of construction activity to levels that are acceptable for the adjacent residential properties. This also includes measures to avoid light-spill upon retained boundary habitats that may be used for foraging or commuting. The magnitude of impact relating to possible disturbance impacts will be negligible adverse during the construction period, leading to a neutral effect.
- 9.9.89 **Habitat fragmentation.** The loss of hedgerows will lead to the fragmentation of interconnected habitat that is used by the local bat population. Levels of bat activity are generally low across the habitats that are contained within the Order Limits, with higher levels of activity associated with the boundaries of fields located to the east and west of Catherine-de-Barnes Lane. Given the known distribution of day roosts identified and also the location of historical roost records, which are associated with the village of Bickenhill, the Scheme will result in the fragmentation of habitat that is used by bats to travel between roost sites and favoured foraging areas. However, as well as the low levels of observed bat activity and the low status of known roosts, it is relevant that connectivity across the footprint of the Scheme is already limited by the interruption of the habitat network by the existing road corridor of Catherine-de-Barnes Lane. The impact of the habitat losses upon the larger, stronger-flying bat species, such as *Nyctalus* sp., is also likely to be less as these bats are capable of crossing open areas.
- 9.9.90 Connectivity around the margins of the Scheme and into the wider landscape will be maintained, for example, by the wider hedgerow network, watercourses and the corridor of the nearby railway line. As illustrated on the Environmental Masterplan on **Figure 8.8 [TR010027/APP/6.2]**, the mix of hedgerows, grassland, scrub and wetland created as part of the Scheme will provide corridors of connecting habitat north-south along the scheme. These will maintain and improve upon the linkages to the retained areas of habitat, including those known to be regularly used by bats, and will therefore further reduce the impact of fragmentation impacts upon the local bat population.

- 9.9.91 The temporary habitat loss will result in the fragmentation of habitats, which represents a magnitude of impact of minor adverse, leading to a slight adverse effect during the construction period. The establishment of habitats that link to adjacent features used by bats will, by the design year, have established and will reduce the magnitude of impact to negligible adverse and the effect to neutral.
- Birds (breeding and wintering)*
- 9.9.92 Surveys have confirmed that the Order Limits supports assemblages of breeding and over-wintering farmland birds that are typical of the habitats present and are each of Local importance. The habitats within the Order Limits are also used on no more than an occasional basis by barn owl. The potential impacts associated with construction are habitat loss, direct mortality and habitat degradation (noise and visual disturbance).
- 9.9.93 **Habitat Loss.** The direct loss of breeding habitat used by farmland birds is unavoidable for a development of this nature. Based on survey results, it is estimated that the following breeding territories of notable bird species will be lost; 20 dunnock, seven skylark, five song thrush, three yellowhammer, three mistle thrush, three willow warbler, two starling, one bullfinch and one linnet (see Appendix 9.6 [TR010027/APP/6.3]).
- 9.9.94 The removal of hedgerow (4.5km), scrub (5.66ha), grassland (16.0ha) and arable farmland (30.31ha) within the Scheme will reduce the availability of breeding habitat and the winter foraging resource that is available for birds. The farmland birds (skylark, yellowhammer and linnet) and scrub specialists (dunnock, bullfinch and willow warbler) will be displaced from their current breeding territories during construction. The farmland in the area surrounding the Order Limits is similar to that associated with land that will be taken by the Scheme, and it is likely the displaced species will continue to be present in these surrounding habitats. Therefore, the Scheme is not considered to impact the local assemblage of farmland bird species present.
- 9.9.95 The losses of farmland, hedgerow and scrub habitat will have adverse impact upon some individual species that are present in greater numbers (dunnock, skylark, song thrush, yellowhammer). The magnitude of impact of habitat loss upon farmland specialists will be permanent and minor adverse, resulting in no more than a slight adverse effect upon these individual species.
- 9.9.96 The direct loss of habitat used by wintering birds will result in the displacement of species into the surrounding area. Given the common and widespread nature of the species present it is considered that this impact is unlikely to undermine the conservation status of the local population.
- 9.9.97 Throughout the period of construction, topsoil mounds and temporarily fallow areas of farmland within the Order Limits will provide opportunities for nesting and foraging birds, which will also reduce the magnitude of the impact of habitat loss upon individual species. Furthermore, the breeding and wintering habitat provided by the hedgerow, scrub and grassland lost during construction will be more than adequately off-set through the replacement of these habitats as an integral part of the Scheme's green infrastructure, which includes 12km hedgerow, 8.09ha scrub

and 34.86ha grassland. Given both the low abundance of both breeding territories and over-wintering birds present and also the provision of replacement habitats, in the design year the Scheme will result in a magnitude of impact of minor beneficial, leading to a slight beneficial effect upon all other breeding and wintering bird species present.

- 9.9.98 **Direct mortality.** Impacts on breeding birds will be avoided through the working methods set out in the OEMP [TR010027/APP/6.11], which will restrict vegetation clearance activities to outside of the breeding bird season, where possible, and will provide protection for birds and their nests throughout the construction period. Therefore, through the appropriate timing of works and/or the avoidance of harm/disturbance to active nests, the magnitude of impact of direct mortality to all breeding bird species will be negligible adverse, leading to a neutral effect in the construction period.
- 9.9.99 **Habitat degradation.** Retained habitat near to the Order Limits may be temporarily degraded during construction in terms of its suitability for nesting and wintering birds. Noise levels will 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, for example skylark. It is relevant that the Scheme is already adjacent to existing major roads (i.e. the M42 motorway and A45), therefore the increase in the level of disturbance during construction is considered to be relatively limited. Accordingly, the temporary magnitude of impact will be negligible adverse, leading to a neutral effect in the construction period.

Otter

- 9.9.100 Otters are likely to use watercourses that cross the Scheme on an occasional basis, and the local population is considered to be of County importance.
- 9.9.101 There will be no loss or fragmentation of any otter habitat as a result of the Scheme. The potential impact of disturbance during construction upon otters is considered below.
- 9.9.102 **Disturbance.** There is a risk that any otters making use of the watercourses within the Order Limits may be disturbed, for example, by a temporary increase in noise or increased human presence during construction. As detailed in the OEMP [TR010027/APP/6.11], pre-construction checks will be carried out to confirm that there has been no change in the status of otter activity, with appropriate avoidance measures implemented in the unlikely event that otters are present. Construction disturbance upon otters is therefore likely to result in a magnitude of impact of negligible adverse, leading to a neutral effect during the construction period.

Harvest mouse

- 9.9.103 Harvest mouse are likely to occupy the tussocky grassland of Bickenhill Meadows SSSI and Castle Hill Farm Meadows LWS, and the population is considered to be of Local importance. The potential impacts to harvest mouse during construction are habitat loss and mortality.
- 9.9.104 **Habitat loss.** There will be only a limited loss of tall grassland habitat that provides suitable opportunities for harvest mouse. The retained habitats will also maintain links to other areas of suitable habitat, such as Bickenhill Meadows SSSI and Castle Hill Farm Meadows LWS. Therefore, any localised loss of habitat is unlikely to undermine the conservation status of harvest mouse and will result in a magnitude of impact of negligible adverse, leading to a neutral effect during the construction period.
- 9.9.105 **Mortality.** There is a risk that construction works may result in the accidental mortality of harvest mouse, for example, through the destruction of nest sites or places of shelter during clearance of Castle Hill Farm Meadows LWS. High levels of increased mortality have the potential to affect the recruitment of adults to the population. Given the availability of alternative areas of suitable habitat in the SSSI and LWS, which are retained and provide suitable breeding habitat for the wider population, it is unlikely that an increase in mortality will undermine the conservation status of harvest mouse. Therefore, any increase in mortality of harvest mouse will result in a magnitude of impact of negligible adverse, leading to a neutral effect during the construction period.

Hedgehog

- 9.9.106 Within the Order Limits, hedgehog are most likely to occupy the cover provided by scrub and hedgerow habitats, and due to declines at a national level the population is considered to be of Local importance. The potential impacts to hedgehog during construction include habitat loss, habitat fragmentation and mortality.
- 9.9.107 **Habitat loss.** There will be losses of scrub and hedgerow habitat that provides suitable opportunities for hedgehog. Although hedgehogs do make use of arable farmland, grassland and woodland, they are known to have a preference for habitats on the urban fringe (due to increased abundance of food) and their presence is also negatively correlated with the presence of badgers, which prey upon hedgehog [REF 9-73]. Therefore, given the arable habitats that dominate the area and the presence of several badger clans, it is likely that the habitats within the Order Limits are used only occasionally by hedgehogs. Therefore, any localised loss of suitable habitat is unlikely to undermine the conservation status of hedgehog and will result in a magnitude of impact of negligible adverse, leading to a neutral effect during the construction period.

- 9.9.108 **Habitat fragmentation.** Fragmentation may occur as a consequence of the removal of habitat that has both the potential to provide cover for hedgehog and provides connections to other habitats in the surrounding area. Although the mainline link road may result in the loss of some cover and connecting habitat, the habitats are already severed by Catherine-de-Barnes Lane. Furthermore, the habitats most likely to be used by hedgehog, particularly the surrounding areas of urban fringe, are either distant from the Scheme or already located in close proximity to Catherine-de-Barnes Lane, and these factors are likely to reduce the importance of connecting habitat for hedgehog within the Order Limits. On this basis, it is considered that the magnitude of impact of fragmentation upon hedgehog will be negligible adverse, leading to a neutral effect during the construction period.
- 9.9.109 **Mortality.** There is a risk that construction works may result in the accidental mortality of hedgehog, for example, through the destruction of day nests or other places of shelter during clearance of scrub. High levels of increased mortality have the potential to affect the recruitment of adults to population. Given the wide availability of alternative areas of suitable habitat in surrounding area, which lie outside the Order Limits and provide suitable breeding and foraging habitat for the wider population, it is unlikely that an increase in mortality will undermine the conservation status of hedgehog. Therefore, any increase in mortality of hedgehog will result in a magnitude of impact of negligible adverse, leading to a neutral effect during the construction period.
- Great crested newts*
- 9.9.110 There are several known and assumed GCN meta-populations within 500m of the Order Limits, and these are considered to be of Local importance. The potential impacts to GCN during construction of the Scheme are loss of habitat, and direct mortality. There are considered to be no fragmentation impacts to any of the GCN populations as a result of the Scheme.
- 9.9.111 **Habitat Loss.** No GCN ponds will be lost to the Scheme. Small GCN meta-populations are known to be supported by ponds 6 and 7 and the pond 13 (see **Figure 9.9** in Appendix 9.9 [TR010027/APP/6.3]). Each of these ponds is located over 250m from the Scheme, which as described by Cresswell & Whitworth [REF 9-74] exceeds the typical dispersal distance of GCN. Furthermore, each of these ponds is surrounded by GCN-suitable terrestrial habitat and is also separated from the Scheme by areas of comparatively unsuitable habitat, i.e. arable fields or short, grazed pasture, which GCN are unlikely to traverse over any distance. Given these factors it is considered reasonable to conclude that these GCN meta-populations do not make use of habitats within the boundary of the Scheme. Based on these factors, it is considered there will be no impacts upon the small GCN populations supported by ponds 6 and 7 and pond 13.

- 9.9.112 A medium GCN meta-population is known to be supported by ponds 11 and 12, and a small population is present in pond 36. A medium population is also assumed to be present in pond 19 (which was not accessible to direct survey). Each of these GCN populations falls within 250m of the Scheme, and are connected (via largely linear habitat linkages) to GCN-suitable terrestrial habitat that may be directly affected during construction. There is no loss of habitat located in close proximity (i.e. within 50m) to any of the ponds. There will be losses from habitats located between 50 – 500m, comprising 0.71ha from ponds 11 and 12, 8.87ha from pond 19 and 0.39ha for pond 36.
- 9.9.113 The majority of these losses are associated with temporary works, for the purpose of utility diversions, the establishment of site compounds or spoil mounds, and will be reinstated in full following works with existing management maintained. The exception is the permanent loss of 0.32ha of habitat located over 250m from ponds 11 and 12. As illustrated in the Environmental Masterplan (see **Figure 8.8 [TR010027/APP/6.2]**) this will be replaced through the creation of 2.09ha of habitat that is suitable for GCN. This replacement habitat within Highways England soft estate will be managed over the long term for the benefit of wildlife, including GCN. The establishment of suitable terrestrial habitat within the Scheme will result in a magnitude of impact of minor beneficial, leading to a slight beneficial effect in the design year.
- 9.9.114 **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. A Natural England EPS derogation licence will be sought to allow for the clearance of GCN terrestrial habitat that is necessary to undertake construction of the Scheme. The approach to this mitigation is detailed as part of a draft Natural England EPS derogation licence that is presented in Appendix 9.19 [**TR010027/APP/6.3**].
- 9.9.115 Wetland habitat (forming part of the Scheme's drainage strategy) and areas of suitable terrestrial habitat will be created during construction. Where a risk is identified that GCN from nearby ponds may encroach into such construction areas then as a precaution, temporary amphibian fencing will be installed around or along boundaries prior to works commencing to prevent entry by GCN, and to avoid any risk of obstruction of GCN to their regularly used habitats. Upon completion of the construction works, the TAF will be removed under supervision of the ECoW.
- 9.9.116 Following the implementation of best working practices to reduce the risk of mortality, including the adoption of a Natural England licence, the magnitude of impact will be negligible adverse, leading to a neutral effect upon GCN during the construction period.
- Invertebrates (terrestrial)*
- 9.9.117 Surveys have demonstrated that the habitats of interest to terrestrial invertebrates are the ancient woodland of Aspbury's Copse pLWS and the areas of semi-improved grassland, which are of County and Local importance for this group. Potential impacts on terrestrial invertebrates relate to habitat loss.

9.9.118 **Habitat Loss.** The majority of habitat lost to the Scheme comprises intensively managed arable fields and is considered to represent poor habitat for invertebrates. Site clearance will involve some limited and localised removal of features that represent suitable habitat for the local assemblage of terrestrial invertebrates, including the woodland (0.46ha) and semi-improved grassland (7.22ha). The impact upon terrestrial invertebrates as a result of woodland loss will be mitigated through a combination of the establishment of woodland and the retention of deadwood habitat. The provision of 34.86ha of grassland within the Scheme will create additional opportunities for a range of terrestrial invertebrates, including the notable species known to be present. Therefore, the limited and temporary losses of habitat used by terrestrial invertebrates will result in a magnitude of impact of negligible adverse, leading to a neutral effect in the design year.

Invertebrates (aquatic)

9.9.119 Ponds within the Order Limits are over-shaded, ephemeral and lack floral diversity, and as such are considered to be of no more than Local importance. The watercourses of Shadow Brook and its tributaries, Hollywell Brook pLWS and Kingshurst Brook pLWS have greater habitat diversity, with moderate to high diversity of aquatic invertebrates, and are therefore of up to County importance. The potential construction impacts upon aquatic invertebrates are habitat loss and habitat degradation. There are considered to be no fragmentation impacts upon aquatic invertebrates.

9.9.120 **Habitat loss.** The ephemeral ponds 8, 39 and 43, which will be lost to the Scheme, are likely to support the aquatic phase of the lifecycle of species from the local invertebrate population. There are, however, a number of similar waterbodies in the surrounding landscape that may be expected to perform a similar ecological function, and the loss of these ponds to the Scheme is therefore unlikely to undermine the conservation status of the local aquatic invertebrate populations. Reed beds forming part of the Scheme's treatment train for the sustainable drainage system will be ephemeral waterbodies, and therefore once established will be capable of supporting aquatic invertebrate fauna.

9.9.121 The loss habitat from Hollywell Brook pLWS is highly localised, being limited to a 20m section adjacent to the M42 motorway, and will result in only limited removal of the associated vegetation that has the potential to provide habitat for aquatic invertebrates. The vast majority of similar habitat that is associated with the riparian habitat of Hollywell Brook will be retained. The retained areas of Hollywell Brook are therefore likely to continue to be sufficient to support the populations of aquatic invertebrates present.

9.9.122 Habitat loss is therefore considered to result in a magnitude of impact of negligible adverse, leading to a neutral effect upon aquatic invertebrates during the construction period.

9.9.123 **Habitat Degradation.** The construction of the proposed culvert extension at Hollywell Brook requires in-channel works that are likely to temporarily affect water quality. The impact will be mitigated through the best practice methods detailed in the OEMP [TR010027/APP/6.11], although there remains a risk that the abundance and diversity of aquatic invertebrates may be temporarily affected. Given the localised nature of the works it is considered that the culvert extension works to Hollywell Brook will result in a magnitude of impact of minor adverse, leading to slight adverse effect during the construction period.

Fish

9.9.124 Consistent with existing desk study records (see Section 9.6), a habitat appraisal of the watercourses crossing the Order Limits indicates that they are of low suitability for fish and are therefore of no more than Local importance for this group. The potential impacts for fish during construction will be habitat loss and habitat degradation.

9.9.125 **Habitat loss.** The loss of habitat from Hollywell Brook pLWS is highly localised and will not alter the function of the watercourse for fish, for example, by influencing its connectivity of the watercourse with similar habitat in the surrounding landscape. Therefore, no impacts upon fish are anticipated as a result of habitat loss.

9.9.126 **Habitat degradation.** Indirect impacts could arise from pollution incidents and siltation from runoff into the river during the construction phase, and if this occurred it will potentially have impacts on potential fish populations downstream of the works. The implementation of pollution prevention best practice described in the OEMP [TR010027/APP/6.11] will be sufficient to reduce the potential of adverse impacts on the fish assemblages present.

9.9.127 The ecological function of Hollywell Brook pLWS shall therefore be maintained for all fish species present, and therefore a magnitude of impact of negligible applies, resulting in a neutral effect during the construction period upon the local fish population.

Fungi and Lichens

9.9.128 The ancient woodland habitat of Aspbury's Copse pLWS supports assemblages of fungi and lichens. This includes species that are characteristic of ancient woodland associated with several hotspots within the wood [REF 9-36], and this fungal assemblage is considered to be of County importance. The lichens have a richer diversity on the western half of Aspbury's Copse pLWS and include nationally scarce species, which are of Regional importance. The potential construction impact upon fungi and lichens relates to habitat loss.

9.9.129 **Habitat loss.** The loss of woodland habitat from Aspbury's Copse pLWS is also likely to result in the localised loss of associated fungi and lichens. Mitigation for the loss of fungi and lichens at Aspbury's Copse pLWS will be provided by the translocation of the ancient woodland soils and deadwood as part of the compensation strategy set out in Section 9.8. The translocation of ancient woodland soils and tree stumps will assist in the retention of fungal mycorrhizae (an essential component of fungal life cycle). Retained deadwood will be carefully selected under the supervision of the ECoW, with a focus on maintaining a mix of both fallen and standing deadwood in conditions similar to those already existing. These mitigation measures will limit the overall impact and maintain the conservation status of lichens and fungi present. Therefore, it is considered that the magnitude of impact upon fungi and lichen within Aspbury's Copse will be negligible adverse, leading to a neutral effect during the construction period.

Operation

9.9.130 This section considers the effects upon designated sites, habitat and fauna during the operational phase of the Scheme.

Air quality

9.9.131 This consideration of operational effects includes alterations in air quality.

9.9.132 Detailed results from the modelling of air quality changes that will occur as a result of the Scheme are presented within Chapter 6 Air quality. The scope of the assessment has included consideration of potential air quality effects upon designated statutory and non-statutory sites⁶ of nature conservation interest. The assessment considers the risk of both toxic effects from oxides of nitrogen and also nutrient enrichment as a result of increased nitrogen deposition. In accordance with best practice the risk for significant effects upon designated sites should first consider the change in NO_x concentrations against the recognised Critical Level of 30µg/m³ [REF 9-75].

9.9.133 As detailed in Chapter 6 Air quality, modelling has demonstrated that the Critical Level will be exceeded at a number of sites. However, consideration in this ecological assessment focuses only on those designated sites where an increase of more than 0.4 µg/m³ can be attributed to the Scheme, as in accordance with best practice any change below this threshold may be considered imperceptible and unlikely to be significant [REF 9-76]. In this regard it is relevant that no new exceedances of the Critical Load are predicted at any of the designated sites as a result of the Scheme, as indicated in **Table 9.10** below.

⁶ Any non-statutory sites that are classed as 'rejected', i.e. which no longer meet the criteria for designation as shown by desk study records, have not been considered in this assessment

Table 9.10: Air quality effects upon designated sites

Site	NO _x with Scheme/g m-3 (iii)	NO _x change/g m-3 (iii)	Deposition with Scheme/ kg N ha-1 year-1	Deposition change/ kg N ha-1 year-1	Change as percentage of critical load (iv)
Bickenhill Meadows SSSI	22.4 to 20.5 (NW unit)	0.50	18.1	0.03	0.2%
Aspbury's Copse pLWS/ ancient woodland (ii)	36.2 (west) to 40.1 (east)	-5.5 (west) to -5.7 (east)	n/a	n/a	n/a
Castle Hill Farm Meadows LWS (i)	29.1	1.4	18.2	0.08	0.4%
Greens Ward Piece LWS	24.2	0.7	18.2	0.04	0.2%

- (i) Grassland habitat
- (ii) Woodland habitat
- (iii) A range of values has been indicated where a 200m transect was modelled (Bickenhill Meadows SSSI only)
- (iv) Relevant Critical Load for habitats taken from www.apis.ac.uk grassland (low and medium altitude hay meadows); 20 - 30 kg N ha-1 year-1

Designated sites of international importance

9.9.134 The extent of the distance separating the Scheme from all designated sites of international importance is considered sufficient to ensure that there are no impact pathways. There is considered to be no change and therefore no impact upon any European sites from the Scheme.

9.9.135 Further detail is provided in the Habitats Regulations Assessment: No Significant Effects Report [TR010027/APP/6.8].

Bickenhill Meadows SSSI

9.9.136 There are no direct impacts to Bickenhill Meadows SSSI during operation of the Scheme; however, there is potential for habitat degradation.

9.9.137 **Habitat degradation.** The separate units of grassland that comprise the Bickenhill Meadows SSSI will fall on either side of the Scheme. Construction of the Scheme will bring a road in closer proximity to the SSSI and there is risk that air quality at the SSSI may be affected. Air quality modelling of the operational phase has demonstrated that the increase in NO_x will exceed the 0.4 µg/m³ threshold, although the total NO_x concentration will remain below the Critical Level as identified in **Table 9.10**. The increase in nitrogen deposition at the point of Bickenhill Meadows SSSI that is closest to the Scheme will be no more than 0.2% of the critical load, and as this falls below 1% it represents an imperceptible change.

9.9.138 It is therefore considered that the conservation status of the SSSI is unlikely to be undermined. The magnitude of impact from any alteration in nutrient status as a result of aerial emissions from the operational period of the Scheme will be negligible adverse, leading to a neutral effect in the design year.

River Blythe SSSI

9.9.139 There will be no direct impacts to River Blythe SSSI during operation of the Scheme; however, there is potential for habitat degradation.

9.9.140 **Habitat degradation.** The route of the River Blythe SSSI crosses the southern end of the Order Limits, which is the point where this river crosses the existing M42 motorway. Due to its close proximity to the M42 motorway the NO_x concentrations at the River Blythe SSSI exceed the Critical Level of 30µg/m³ both with and without the Scheme. Despite this any change in NO_x concentrations falls as a result of the Scheme is not above 0.4µg/m³ and represents an imperceptible change. Notwithstanding this, river habitats such as that present are known to be phosphorus-limited, and nitrogen deposition as a result of aerial emissions is unlikely to have a significant influence upon the ecology of the SSSI's aquatic habitats. There is therefore considered to be a magnitude of impact of no change as a result of altered air quality upon the River Blythe SSSI, leading to a neutral effect in the design year.

9.9.141 The Scheme is linked to the River Blythe SSSI via several watercourses, including Hollywell Brook pLWS and Shadow Brook and its tributaries. There is potential for indirect impacts to the River Blythe SSSI as a result of altered water quality during operation of the Scheme, for example via increased levels of de-icing salt or pollution incidents from traffic collisions. The mitigation measures presented within Chapter 14 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 higher standards than at present. Therefore, during operation, a magnitude of impact of negligible adverse relating to altered water quality upon the River Blythe SSSI applies, resulting in a neutral effect in the design year.

Coleshill & Bannerly Pools SSSI

9.9.142 Coleshill & Bannerly Pools SSSI comprises a valley mire system that is located next to the M42. There will be no direct loss of habitat from the SSSI during operation of the Scheme; however, there is potential for indirect impacts resulting in habitat degradation.

9.9.143 **Habitat degradation.** The habitats of Coleshill & Bannerly Pools SSSI that are closest to the M42 motorway exceed the Critical Level of 30µg/m³ NO_x both with and without the Scheme. Despite this, any change in NO_x concentrations as a result of the Scheme falls below 0.4µg/m³ and therefore represents an imperceptible change. The magnitude of impact of altered air quality upon Coleshill & Bannerly Pools SSSI will therefore be negligible adverse, leading to a neutral effect in the design year.

9.9.144 As described in Chapter 14 Road drainage and the water environment, there are considered to be no hydrological connections to the SSSI, and on this basis the magnitude of impact resulting from altered hydrology during operation of the Scheme will be no change, leading to a neutral effect in the design year.

Non-statutory designated sites

9.9.145 There will be no loss of habitat from any of the 29 identified non-statutory sites during operation. The potential operational impacts upon these sites therefore relates to habitat degradation and improvement.

9.9.146 **Habitat degradation and improvement.** Castle Hill Farm Meadows LWS is a large area of diverse grassland, a small proportion of which lies adjacent to the Scheme. Modelling of changes in air quality has identified that the change in NO_x concentrations at this LWS will exceed than 0.4 µg/m³ as a result of the Scheme (see **Table 9.10**). Despite this prediction of a perceivable change in NO_x levels, the total concentrations fall well below the Critical Level at this designated site. Therefore, the magnitude of impact during the operational period will be negligible adverse, leading to a neutral effect in the design year.

9.9.147 The increase in nitrogen deposition at the point of Castle Hill Farm Meadows LWS that is closest to the Scheme will be no more than 0.4% of the critical load, which represents an imperceptible change. On this basis it is considered that the conservation status of Castle Hill Farm Meadows LWS is unlikely to be undermined, and the magnitude of impact from any alteration in nutrient status as a result of aerial emissions from the Scheme will be negligible adverse during the operational period, leading to a neutral effect in the design year.

9.9.148 Greens Ward Piece LWS is a separate area of damp grassland that together with Bickenhill Meadows SSSI (SE unit) forms Shadow Brook Nature Reserve. As a result of the Scheme there is a perceivable change in NO_x concentrations at this LWS that exceed the 0.4 µg/m³ threshold (see **Table 9.10**). However, the total concentrations fall well below the Critical Level at this designated site and the magnitude of impact from the concentrations of nitrogen oxides in atmosphere are considered to be negligible adverse in the operational period, leading to a neutral effect in the design year.

9.9.149 The increase in nitrogen deposition at the point of Greens Ward Piece LWS that is closest to the Scheme will be no more than 0.4% of the critical load, and as this falls below 1% it represents an imperceptible change. It is therefore considered that the conservation status of Greens Ward Piece LWS is unlikely to be undermined, and the magnitude of impact from any alteration in nutrient status as a result of aerial emissions from the Scheme will be negligible adverse in the operational period, leading to a neutral effect.

9.9.150 The change in air quality for all other non-statutory sites presented in **Table 9.8**, including Aspbury's Copse pLWS (see **Table 9.10**), falls below the threshold of 0.4 µg/m³ and is therefore imperceptible (see Chapter 6 Air Quality). Therefore, the magnitude of impact of altered air quality upon other non-statutory sites as a result of the Scheme will be negligible adverse in the operational period, leading to a neutral effect in the design year.

- 9.9.151 Where it occurs at high levels, the spray from traffic on the carriageway may have adverse impacts on sensitive vegetation communities, mainly as a result of the associated increase in soil salt concentrations. However, typically sprays from carriageways are largely confined to areas close to the carriageway, i.e. within 5m [REF 9-27]. The distance separating all non-statutory sites (i.e. the inclusion of a highway boundary) from the Scheme is therefore sufficient to avoid the operational impact of spray from the carriageway.
- 9.9.152 There is potential for indirect impacts to watercourses as result of altered water quality from the operational Scheme, for example increased levels of de-icing salt or pollution incidents from traffic collisions. This may affect the running water associated with the following designated sites; Hollywell Brook pLWS, Kingshurst Brook/Low Brook, headwaters & tributaries pLWS and Shadow Brook Ecosite. These mitigation measures include provision of appropriate measures for treatment of surface water to mitigate pollution to higher standards than at present.
- 9.9.153 As reported in Chapter 14 Road drainage and the water environment, the improvement of water treatment from the Scheme will result in a beneficial effect in the water quality of Hollywell Brook pLWS. Through changes in water quality, this will improve the environmental conditions of this watercourse, increasing the habitats resilience and resulting in a magnitude of impact of minor beneficial upon the pLWS in the operational period, resulting in a slight beneficial effect in the design year.
- 9.9.154 The Scheme will similarly increase the water quality associated with Shadow Brook Ecosite, although this watercourse will receive seasonal increases in de-icing salt (see Chapter 14 Road drainage and the water environment). On balance these changes are unlikely to alter the existing condition of habitat associated with Shadow Brook Ecosite, and therefore the magnitude of impact upon this watercourse is considered to be negligible adverse in the operational period, leading to a neutral effect in the design year.
- 9.9.155 Overall, with mitigation, the magnitude of impact associated with altered water quality upon all other watercourses (Kingshurst Brook/Low Brook, headwaters & tributaries pLWS) will be negligible adverse in the construction period, leading to a neutral effect in the design year.

Habitats

- 9.9.156 There will be no direct loss of habitat during operation of the Scheme; however, there may be potential for habitat degradation.
- 9.9.157 **Habitat Degradation.** Sprays from carriageways may have a detrimental effect upon vegetation, although this is largely confined to areas close to the carriageway i.e. within 5m [REF 9-27]. Any spray will therefore be limited to the habitats that are located close to road verges, which will either be newly created or already subject to the spray from the existing roads. Some highly localised influence on vegetation communities immediately adjacent to the Scheme may occur, but this is unlikely to undermine the conservation status of the habitats present. Therefore the magnitude of impact of spray upon all habitats is

considered to be negligible adverse in the operational period, leading to a neutral effect in the design year.

- 9.9.158 There is potential for habitat degradation as a result of pollution, such as pollution incidents from traffic collisions. Mitigation measures set out in Chapter 14 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 higher standards than at present. Therefore, the magnitude of impact to habitats as a result of altered hydrology is considered to be negligible adverse in the operational period, leading to a neutral effect in the design year.

Badgers

- 9.9.159 There is a potential risk of increased mortality during operation.
- 9.9.160 **Direct mortality.** There are existing records of accidental badger mortalities along Catherine-de-Barnes Lane (see Appendix 9.4 [TR010027/APP/6.3] [CONFIDENTIAL]), indicating that the badger population currently move across this road. Mitigation measures incorporated into the design of the Scheme to maintain habitat connectivity, including the use of tunnels and fencing, will mitigate the risk of accidental mortality of badgers through their collision with vehicles. This will represent an improvement over the existing situation at Catherine-de-Barnes Lane. Therefore, these measures are considered to result in a magnitude of impact of minor beneficial in the operational period, leading to a slight beneficial effect on badgers in the design year.

Bats

- 9.9.161 The potential operational impacts upon bats relate to direct mortality and habitat degradation.
- 9.9.162 **Direct mortality.** The severance of flight lines has the potential to increase levels of bat mortality through accidental collision with vehicles. Direct collision resulting in mortality of bats occurs in areas where bats will 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, for example pipistrelles which are more likely to attempt to cross larger unsheltered and open spaces at a height that may bring them into the path of oncoming vehicles. Species that regularly fly at height, for example noctule bats, may reasonably be expected to either avoid or fly over the road. Although some regularly used flight lines may be impacted upon, the risk of accidental mortality is likely to be reduced for vulnerable bat species as the majority of the Scheme is in cutting. Therefore, it is considered accidental mortality is unlikely to adversely impact the conservation status of the local bat population, and the magnitude of impact on all bat species will be negligible adverse in the operational period, leading to a neutral effect in the design year.

9.9.163 **Habitat degradation.** Artificial lighting has the potential to impact upon bats, causing them to avoid otherwise suitable areas of habitat [REF 9-77]. The design of lighting has been developed to minimise light-spill onto adjacent habitats, including where there are potential roosts or important foraging and/or commuting habitat that is regularly used by the local bat population.

9.9.164 Furthermore, the majority of the length of the new mainline link road will be unlit (with new lighting limited to Barber's Coppice Roundabout and the approaches to M42 Junction 5A and Clock Interchange), where artificial lighting is already present on the existing road network. Given these factors it is considered that the magnitude of impact effect of artificial lighting upon the bat population will be negligible adverse in the operational period, leading to a neutral effect in the design year.

Birds (excluding barn owl)

9.9.165 The bird populations present (breeding and wintering) may be impacted by an increase in direct mortality, as follows.

9.9.166 **Direct mortality.** Certain birds, for example thrush species 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 design of the Scheme incorporates steep embankments and drainage areas along the verges (rather than vegetation), which thereby reduce the risk of direct mortality. Therefore, the magnitude of impact of bird mortality as a result of collision with vehicles will be negligible adverse in the operational period, resulting in a neutral effect in the design year.

Barn owl

9.9.167 There is a risk of direct mortality to barn owl from the Scheme.

9.9.168 **Direct mortality.** Accidental collision with vehicles is known to be a cause of significant levels of mortality in barn owl populations [REF 9-78]. The risk of accidental collisions of traffic with barn owl during operation of the new mainline link road will be managed through the use of fencing and the establishment of tall vegetation on the verges. These measures will be established on both verges south of the new mainline link road. The purpose of the fence and vegetation (hedges and scrub) will be to guide the flight path of barn owls over the new mainline link road. Maintenance of the fence and vegetation shall form part of the management of the Highways England soft estate. Therefore, the magnitude of impact upon barn owls as a result of increased mortality will be negligible adverse in the operational period, leading to a neutral effect in the design year.

Aquatic species

9.9.169 Fish and aquatic invertebrates exist in the same ecological habitat, and will be subject to the same potential impacts that are associated with the operational phase of the Scheme. As such, these groups have been grouped together. There will be no direct impacts to the habitats supporting these groups during operation; however, there may be impacts as a result of habitat degradation.

9.9.170 **Habitat degradation.** There is potential for indirect impacts associated with pollution from incidents such as traffic collisions. Mitigation measures set out in Chapter 14 Road drainage and the water environment for managing surface water runoff from the road includes provision of measures for treatment to mitigate pollution to higher standards than at present. The magnitude of impact in relation to habitat degradation will be negligible adverse in the operational period, leading to a neutral effect in the design year.

Other fauna

9.9.171 There are considered to be no operational impacts to any other fauna, including GCN, terrestrial invertebrates or harvest mouse. The magnitude of impact upon these species and groups in the operational period is considered to be no change, resulting in a neutral effect in the design year.

Summary of significant effects

9.9.172 Based on the implementation of all ecological mitigation and compensation measures described in Section 9.8, and with reference to the assessment criteria applied in the assessment, the Scheme will result in a moderate adverse effect (significant) as a result of the loss of 0.46ha from the ancient woodland of Aspbury's Copse pLWS. This significant effect is reported because as recognised by planning policy, including the NPSNN [REF 9-7], ancient woodland represents an irreplaceable habitat.

9.9.173 Compensation for the ecological function of this ancient woodland will be achieved through the translocation of ancient woodland soils (forming part of the compensation strategy) to a receptor site, and then through the long term management of this receptor site and Aspbury's Copse pLWS to establish well-structured woodland. In line with local conservation objectives these measures will also result in a net increase the total area of woodland coverage.

9.10 Monitoring

Aspbury's Copse pLWS

9.10.1 The identified significant effects that the Scheme is predicted to have on Aspbury's Copse pLWS, and the effectiveness of the compensation measures (comprising the translocation of ancient woodland soils and new woodland planting) will be evaluated through monitoring.

9.10.2 Following construction of the Scheme, monitoring will be undertaken within Aspbury's Copse pLWS and the ancient woodland receptor area to:

- a. establish the composition and extent of ancient woodland indicator plant species (surveys are likely to be undertaken annually); and
- b. confirm the presence and extent of associated fungi and lichen species, and the abundance of deadwood material (surveys are likely to be undertaken every three to five years).

- 9.10.3 The monitoring will serve to update current baseline data, and will be used to measure the success of the establishment of the compensatory woodland planting and permit an evaluation of its ecological function (which will be evidenced by the colonisation of woodland plant, fungi and lichen species).
- 9.10.4 Where necessary, the assessment of monitoring data will inform the prescriptions for the future management of Aspbury's Copse pLWS and the receptor area, in order to support the continued maintenance of the conservation status of this woodland resource.
- 9.10.5 An outline monitoring programme for Aspbury's Copse pLWS will be incorporated into the BMP, which will also include triggers for management actions as necessary.

Bickenhill Meadows SSSI

- 9.10.6 As detailed in Section 9.8, ongoing dipwell monitoring is currently being undertaken at Bickenhill Meadows SSSI.
- 9.10.7 Continued monitoring will be undertaken at Bickenhill Meadows SSSI to verify the conclusion reported within the assessment that the Scheme will not result in a significant environmental effect on the MG4 and MG5 vegetation communities within the SSSI. This will take the form of:
- a. annual hydrological monitoring: involving the monitoring of water levels in dipwells that have been installed within the NW and SE units of the SSSI, to provide further information on fluctuations in water levels experienced over time; and
 - b. detailed habitat monitoring: involving botanical monitoring within the boundary of the SSSI to establish and report on the extent of vegetation communities present in the SSSI and their relationship to the site's topography, with any changes in extent and/or composition of these plant communities reported.
- 9.10.8 Information gathered from this continued monitoring will be used to validate the existing conceptual model of the SSSI (see Appendix 14.2 [TR010027/APP/6.3]), inform the design of the solution and will also be used to identify whether any changes in water level or vegetation type(s) have occurred post-construction of the Scheme.
- 9.10.9 The reporting and evaluation of the monitoring results will be shared with Natural England.
- 9.10.10 The period of post-construction monitoring will be confirmed and agreed through consultation with Natural England.

9.11 References

REF 9-1	The Conservation of Habitats & Species Regulations. HMSO (2017). http://www.legislation.gov.uk/ukxi/2017/1012/contents/made
REF 9-2	Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora. European Commission (1992). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A31992L0043
REF 9-3	Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds. European Commission (2009). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32009L0147
REF 9-4	Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat (1971). http://portal.unesco.org/en/ev.php-URL_ID=15398&URL_DO=DO_TOPIC&URL_SECTION=201.html
REF 9-5	The Wildlife & Countryside Act 1981. HMSO (1981). https://www.legislation.gov.uk/ukpga/1981/69
REF 9-6	The Countryside and Rights of Way Act 2000. HMSO (2000). https://www.legislation.gov.uk/ukpga/2000/37/contents
REF 9-7	The Natural Environment and Rural Communities Act 2006. HMSO (2006). https://www.legislation.gov.uk/ukpga/2006/16/contents
REF 9-8	UK Post-2010 Biodiversity Framework. Joint Nature Conservation Committee and Department for Environment, Food and Rural Affairs (2012). http://jncc.defra.gov.uk/pdf/UK_Post2010_Bio-Fwork.pdf
REF 9-9	Protection of Badgers Act 1992. London: HMSO (1992). https://www.legislation.gov.uk/ukpga/1992/51/contents
REF 9-10	The Hedgerow Regulations 1997. HMSO (1997). http://www.legislation.gov.uk/ukxi/1997/1160/contents/made
REF 9-11	The Salmon and Freshwater Fisheries Act 1975. HMSO (1975). https://www.legislation.gov.uk/ukpga/1975/51
REF 9-12	Animal Welfare Act 2006. HMSO (2006). http://www.legislation.gov.uk/ukpga/2006/45/pdfs/ukpga_20060045_en.pdf
REF 9-13	Wild Mammals (Protection) Act 1996. London: HMSO (1996). https://www.legislation.gov.uk/ukpga/1996/3/contents
REF 9-14	National Policy Statement for National Networks. Department for Transport (2014). https://www.gov.uk/government/publications/national-policy-statement-for-national-networks

REF 9-15	National Planning Policy Framework. Ministry of Housing, Communities and Local Government (2018). https://www.gov.uk/government/publications/national-planning-policy-framework--2
REF 9-16	National Planning Practice Guidance. Ministry of Housing, Communities and Local Government (2016-2018). https://www.gov.uk/government/collections/planning-practice-guidance
REF 9-17	Solihull Local Plan: Shaping a Sustainable future. Solihull Metropolitan Borough Council (2013). http://www.solihull.gov.uk/Portals/0/Planning/LDF/Local_Plan_Final.pdf
REF 9-18	Warwickshire Coventry and Solihull Local Biodiversity Action Plan. Warwickshire Wildlife Trust (2015 to 2017). http://www.warwickshirewildlifetrust.org.uk/LBAP
REF 9-19	Solihull Green Infrastructure Study. Solihull Metropolitan Borough Council (2012). http://www.solihull.gov.uk/Portals/0/Planning/LDF/Solihull_Green_Infrastructure_Study.pdf
REF 9-20	Protected species: how to review planning applications. Natural England and the Department for Environment, Food & Rural Affairs (2016). https://www.gov.uk/environment/protected-sites-species
REF 9-21	Biodiversity 2020, A strategy for England's wildlife and ecosystem Department for Environment, Food & Rural Affairs (2011). https://www.gov.uk/government/publications/biodiversity-2020-a-strategy-for-england-s-wildlife-and-ecosystem-services
REF 9-22	Nature Conservation in Solihull. Solihull Metropolitan Borough Council (2010). http://www.solihull.gov.uk/Portals/0/StrategiesPlansPolicies/LandscapeandEcology/Nature_Conservation_Strategy.pdf
REF 9-23	Road Investment Strategy for the 2015/16 to 2019/20 Road Period. Department for Transport (2015). https://www.gov.uk/government/collections/road-investment-strategy
REF 9-24	Highways England: Our plan to protect and increase biodiversity. Highways England (2015). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/441300/N150146_-_Highways_England_Biodiversity_Plan3lo.pdf
REF 9-25	M42 Junction 6 Improvement Scheme: Environmental Impact Assessment Scoping Report. Highways England (2017). https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010027/TR010027-000016-M42%20Junction%206%20Improvement%20Scheme%20-%20EIA%20Scoping%20Report.pdf

REF 9-26	M42 Junction 6 Improvement Scheme: Environmental Impact Assessment Scoping Opinion. The Planning Inspectorate (2017). https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR010027/TR010027-000013-42J6%20-20Scoping%20Opinion.pdf
REF 9-27	Design Manual for Roads & Bridges Volume 11 Environmental Assessment, Section 2 Environmental Impact Assessment Part 5 HA205/08 Assessment & Management of Environment Effects. Highways England (2008). http://www.standardsforhighways.co.uk/ha/standards/dmr/vol11/section2/ha20508.pdf
REF 9-28	Design Manual for Roads and Bridges: Environmental Assessment Update. Interim Advice Note 125/15. Highways England (2015). http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian125r2.pdf
REF 9-29	Design Manual for Roads and Bridges: Interim Advice Note 130/10 Ecology and Nature Conservation: Criteria for Impact Assessment. Highways England (2010). http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian130.pdf
REF 9-30	Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, second Edition. Chartered Institute of Ecology and Environmental Management (2018). https://www.cieem.net/data/files/ECIA%20Guidelines.pdf
REF 9-31	Guidelines for the Selection of Biological SSSIs. Joint Nature Conservation Committee (2013). http://jncc.defra.gov.uk/page-2303
REF 9-32	UK Biodiversity Action Plan. HMSO (1994-2012). http://jncc.defra.gov.uk/ukbap
REF 9-33	Ancient Woodland Inventory. Natural England (2018). https://data.gov.uk/dataset/9461f463-c363-4309-ae77-fdcd7e9df7d3/ancient-woodlands-england
REF 9-34	Natural Character Area profile 97 Arden. Natural England (2014). http://publications.naturalengland.org.uk/publication/1819400
REF 9-35	The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017. The Stationary Office (2017). http://www.legislation.gov.uk/uksi/2017/572/contents/made
REF 9-36	Motorway Service Area (MSA) and New Junction between Junctions 5 & 6 of the M42, Solihull Fungi Survey Report. Wardell Armstrong (2015). No weblink available.
REF 9-37	Motorway Service Area (MSA) and New Junction between Junctions 5 & 6 of the M42, Solihull Lichen Survey. Wardell Armstrong (2015). No weblink available.

REF 9-38	Design Manual for Roads and Bridges, Volume 11, Section 4, Part 1, HD44/09. Assessment of implications (of highways and/or roads projects) on European Sites (including Appropriate Assessment). Highways Agency (2009). http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section4/hd4409.pdf
REF 9-39	Surveying Badgers. An Occasional Publication of the Mammal Society No. 9. Harris S., Cresswell P. & Jefferies, D. (1989). No weblink available.
REF 9-40	Design Manual for Roads and Bridges: Volume 10 Section 4 Part 2. Mitigating Against Effects on Badgers. Design Manual for Roads and Bridges. Highways England (1993). http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol10/section4/ha5992.pdf
REF 9-41	The Green Book: Guidance for the Selection of Local Wildlife Sites in Warwickshire, Coventry and Solihull. Local Wildlife Sites Project. Guidance Notes on the Application of Site Selection Criteria. Warwick: Habitat Biodiversity Audit. Warwickshire Wildlife Trust (2013). https://apps.warwickshire.gov.uk/api/documents/WCCC-863-559
REF 9-42	Valuing bats in ecological impact assessment. In Practice, No. 70, Institute of Ecology and Environmental Management. Wray. S., Wells. D., Long. E. and Mitchell-Jones. T. (2010). http://bailey.persona-pi.com/Public-Inquiries/A465-English/11%20-%20Nature%20Conservation/11.3.69%20-%20Valuing%20Bats%20in%20EIA%202010%20-%20CIEEM%20In%20Practice%20Article.pdf
REF 9-43	Birds of Conservation Concern 4: the Population Status of Birds in the UK, Channel Islands and Isle of Man. British Birds 108: 708-746. Eaton, M., Aebischer, N., Brown, A., Hearn, R., Lock, L., Musgrove, A., Noble, D., Stroud, D. & Gregory, R. (2015). https://www.bto.org/science/monitoring/psob
REF 9-44	Farmland Birds. Warwickshire Wildlife Trust (2017). http://www.warwickshirewildlifetrust.org.uk/sites/default/files/files/FarmlandBirds_May_2017_1.pdf
REF 9-45	Barn Owls. Warwickshire Wildlife Trust (2017). http://www.warwickshirewildlifetrust.org.uk/sites/default/files/files/BarnOwl_%202017_1.pdf
REF 9-46	Moffat, R. (2017). Much ado about something: securing a future for Warwickshire's Dormice. British Wildlife 28 (6), 399-404. No weblink available.

REF 9-47	High Speed 2 (HS2) Limited (2013). https://www.gov.uk/government/publications/hs2-phase-one-environmental-statement-volume-5-ecology/hs2-phase-one-environmental-statement-volume-5-ecology
REF 9-48	Otter Draft revised plan – August 2015. Warwickshire Wildlife Trust (2015). http://www.warwickshirewildlifetrust.org.uk/sites/default/files/files/Otter%20-%20August%202015.pdf 2015 - Otter
REF 9-49	Water Vole Draft Revised Plan. Warwickshire Wildlife Trust (2014). http://www.warwickshirewildlifetrust.org.uk/sites/default/files/files/Water%20Vole%20August%202015.doc
REF 9-50	Hedgehogs Draft Revised Plan 2015. Warwickshire Wildlife Trust (2015). http://www.warwickshirewildlifetrust.org.uk/sites/default/files/files/Hedgehog%20-%20August%202015.pdf
REF 9-51	Mammals of the British Isles: Handbook, 4th Edition. The Mammal Society. Harris S. & Yalden D. W. (2008). No weblink available.
REF 9-52	Polecat. Warwickshire Wildlife Trust (2018). http://www.warwickshirewildlifetrust.org.uk/species/polecat
REF 9-53	The Distribution and Status of the Polecat (<i>Mustela putorius</i>) in Britain 2014-2015. The Vincent Wildlife Trust. Croose E (2006). https://www.vwt.org.uk/wp-content/uploads/2016/04/Polecat-Report-2016.pdf
REF 9-54	Great Crested Newt Revised Plan September 2015. Warwickshire Wildlife Trust (2017). http://www.warwickshirewildlifetrust.org.uk/sites/default/files/files/GreatCrestedNewt-September-2015.pdf
REF 9-55	Motorway Service Area (MSA) and New Junction between Junction 5 & 6 of the M42, Solihull – Great Crested Newt Survey – 2018 Update. A report produced on behalf of Extra MSA Group. Wardell Armstrong (2018). https://publicaccess.solihull.gov.uk/online-applications/files/FB28CEBA228A214EEE42E805FE8E2A7C/pdf/PL_2015_51409_PPOL-GREAT_CRESTED_NEWT_SURVEY-893343.pdf
REF 9-56	Herpetofauna Workers Manual. Gent. T and Gibson, S. (2003). http://jncc.defra.gov.uk/page-3325
REF 9-57	Froglife Advice Sheet 10: reptile survey. Froglife, London. Froglife (1999). http://www.froglife.org/wp-content/uploads/2014/01/FAS_10.pdf
REF 9-58	Publications and Resources. International Union for the Conservation of Nature (2018). https://www.iucnredlist.org/resources/grid
REF 9-59	Invertebrates: surveys and mitigation for development projects. Natural England and Department for Environment, Food & Rural Affairs (2015). https://www.gov.uk/guidance/protected-invertebrates-protection-surveys-and-licences

REF 9-60	White-Clawed Crayfish Revised Plan May 2017. Warwickshire Wildlife Trust (2017). http://www.warwickshirewildlifetrust.org.uk/sites/default/files/files/Whiteclawedcrayfish_May%202017_1.pdf
REF 9-61	Black Poplar. Warwickshire Wildlife Trust (2015). http://www.warwickshirewildlifetrust.org.uk/sites/default/files/files/BlackPoplar%20-%20August%202015.pdf
REF 9-62	CIRIA C600. Habitat translocation – a best practice guide. Construction Industry Research and Information Association. Penny Anderson. (2003). https://www.thenbs.com/PublicationIndex/documents/details?Pub=CIRIA&DocID=264131
REF 9-63	Journal of Environmental Planning and Management 46(6) pp239 – 856 Critical Factors and Evaluation Criteria for Habitat Translocation. Carfax Publishing. Box J (2018).
REF 9-64	BS 5837:2012 Trees in relation to design, demolition and construction. Recommendations. British Standards Institute (2012). http://www.crawley.gov.uk/pub_livx/groups/operational/documents/plappcomment/ehfp2040459_attachment_1.pdf
REF 9-65	CIRIA C532 - Control of water pollution from construction sites: Guidance for consultants and contractors. Construction Industry Research and Information Association (2001). https://www.thenbs.com/PublicationIndex/documents/details?Pub=CIRIA&DocID=252367
REF 9-66	CIRIA C650 - Environmental good practice on site. Construction Industry Research and Information Association (2005). https://warwick.ac.uk/fac/sci/eng/eso/modules/year4/es94y/c692_environmental_good_practice_on_site_3rd_edition.pdf
REF 9-67	CIRIA C648. Control of water pollution from linear construction projects: Technical guidance. Construction Industry Research and Information Association (2006). https://www.brebookshop.com/details.jsp?id=190484
REF 9-68	Highways England: Licence – Secretary of State for Transport statutory directions and guidance to the strategic highways company. Department for Transport (2015). https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/431389/strategic-highways-licence.pdf
REF 9-69	B.D. Wheeler, D.J.G. Gowing, S.C. Shaw, J.O. Mountford & R.P. Money Ecohydrological Guidelines for Lowland Wetland Plant Communities. Environment Agency (2004). http://www.floodplainmeadows.org.uk/sites/www.floodplainmeadows.org.uk/files/files/Eco%20Hydrological%20Guidelines%20(1).pdf

REF 9-70	Journal of Ecology, Vol 72 (1) pp 155-182. Historical Factors Affecting the Number and Distribution of Vascular Plant Species in the Woodlands of Central Lincolnshire. Peterken, G. F. & M. Game (1984). No weblink available.
REF 9-71	A2/M2 Cobham to Junction 4 widening scheme ten year ecological monitoring strategy 2000 - 2009. Hyder Consulting (2012). No weblink available.
REF 9-72	Translocation and Ancient Woodland. The Woodland Trust. Ryan, L. (2012). http://www.woodlandtrust.org.uk/mediafile/100263193/rr-wt-71014-translocation-and-ancient-woodland.pdf?cb=3b494f2c843c4c6588a1d0c9c8aa0218
REF 9-73	Factors affecting hedgehog (<i>Erinaceus europaeus</i>) attraction to rural villages in arable landscapes. Pettett, C.E., Moorhouse, T.P., Johnson, P.J. Macdonald, D. W. Eur J Wildl Res 63: 54 (2017). No weblink available.
REF 9-74	English Nature Research Report – Number 576 - An assessment of the efficiency of capture techniques and the value of different habitats for the great crested newt <i>Triturus cristatus</i> . English Nature. Cresswell W & Whitworth R (2004). http://publications.naturalengland.org.uk/publication/134002
REF 9-75	Design Manual for Roads & Bridges Volume 11 Environmental Assessment, Section 3 Environmental Assessment Techniques Part 1 HA207/08 Air Quality. Highways Agency (2008). http://www.standardsforhighways.co.uk/ha/standards/dmr/vol11/section3.htm
REF 9-76	Design Manual for Roads and Bridges: Interim Advice Note 174/13 Updated advice for evaluating significant local air quality effects for users of DMRB Volume 11, Section 3, Part 1 'Air Quality' (HA 207/07). Highways Agency (2012). http://www.standardsforhighways.co.uk/ha/standards/ians/pdfs/ian174.pdf
REF 9-77	Artificial lighting and wildlife Interim Guidance: Recommendations to help minimise the impact artificial of lighting. Bat Conservation Trust (2014). https://www.bats.org.uk/publications_download.php/1330/BCT_Interim_Guidance_Artificial_Lighting_June_2014.pdf
REF 9-78	Impact of Roads on Barn Owl <i>Tyto alba</i> Populations. Highways Agency, London. Shawyer, C. R. and Dixon, N. (1999). http://programmeofficers.co.uk/Preston/CoreDocuments/LCC356.pdf