

11 Nature conservation

Executive summary

This chapter considers how the scheme would potentially affect ecology and nature conservation. It has been prepared in accordance with latest best practice guidance for ecological impact assessment and specifically the ecological assessment of road schemes.

Surveys to inform the EIA were focussed on features that were considered to be of at least local nature conservation value, following a provisional ecological evaluation of features based on available pre-existing information, or where information is required to ensure compliance with protected species legislation.

Whilst the land within the scheme boundary predominantly comprises agricultural fields of relatively low ecological value, there are a number of valuable habitats present, specifically woodland, standing and running water, swamp and marginal vegetation and semi-improved grassland. There are a number of statutory and non-statutory designated sites within the immediate vicinity of the scheme and the area supports a range of notable and protected species including: aquatic and terrestrial invertebrates; fish; great crested newt; breeding and wintering birds, including barn owl; bats; otter; and water vole.

Mitigation to reduce the impact of the scheme on ecology has been identified. This mitigation seeks to avoid impacts in the first instance, through carefully siting infrastructure away from sensitive habitat and timing works to avoid sensitive periods. Other principles adopted in the mitigation strategy are to ensure no net loss of valued habitats; maintain dispersal corridors across the scheme using culverts and structural planting (in conjunction with fencing and sensitive lighting); increase connectivity along the scheme with new landscaping using native, locally appropriate species; minimise culverting of watercourses where practicable; and the creation of new habitats along the highways estate in order to achieve net habitat gain along the scheme. Mitigation would reduce the potential for adverse effects and provide some potential positive effects.

Moderate adverse effects are predicted in the *Environmental Statement (ES)* for breeding birds at Buckden Gravel Pits as a result of disturbance during the operational phase of the scheme. This finding is based on a precautionary approach which takes into account a lack of certainty over how birds would respond or habituate to traffic noise and how they would utilise habitats created as part of the scheme. It is also considered probable that bats would suffer moderate adverse effects as a result of disturbance and direct mortality (vehicle collisions) during operation. Mitigation measures to reduce these effects include habitat creation, provision of bat boxes and additional roost sites, timing of works to avoid sensitive periods, and the provision of culverts, bat hop-overs and linear planting.

Beneficial effects are anticipated from habitat created for groups/species including aquatic and terrestrial invertebrates, fish, great crested newt, breeding birds, bats and water vole.

11.1 Introduction

- 11.1.1 This chapter considers how the scheme would potentially affect ecology and nature conservation. It aims to:
- identify and evaluate species, habitats and designated sites which have potential to be affected by the scheme;
 - assess potential construction and operational impacts;
 - describe appropriate mitigation measures; and
 - identify those residual effects which are significant.
- 11.1.2 The chapter has been prepared in accordance with latest best practice guidance for ecological impact assessment (Chartered Institute of Ecology and Environmental Management (CIEEM) (2006), *Design Manual for Roads and Bridges Volume 11, Section 3, Part 4 – ‘Ecology and Nature conservation’* (Highways Agency et al., 1993) and *Interim Advice Note (IAN) 130/10, ‘Ecology and Nature Conservation: Criteria for Impact Assessment’*, (Highways Agency, 2010), as well as current best practice guidance documents for the survey and assessment of specific species and habitats (which are referenced in full in the technical reports provided in *Appendices 11.1-11.11*).
- 11.1.3 Direct impacts from road infrastructure projects can arise from direct habitat loss or increased mortality of species as well as via indirect effects such as severance, disturbance and changes in environmental conditions. As indirect impacts can occur through changes in hydrology, pollution of air and water and via noise, this chapter is supported by information from the following chapters of the *ES*:
- *Chapter 8 (Air Quality)*;
 - *Chapter 14 (Noise and Vibration)*; and
 - *Chapter 17 (Road Drainage and the Water Environment)*.
- 11.1.4 The Draft National Policy Statement for National Networks (NPS NN) states that “*the value of nature and the range of services that ecosystems provide to society should be at the heart of any decision*” (*Department of Transport 2013*). Government policy as laid out in the Natural Environment White Paper (NEWP) (*Defra, 2011*) provides the definition of ecosystem services as ... “*the products of natural systems from which people derive benefits, including goods and services...*”, and sets out the principles that *all roles of ecosystems are underpinned by biodiversity; the level and stability of ecosystem services generally improve with increasing levels of biodiversity*”. This chapter considers effects on biodiversity in detail, in keeping with NPS NN guidance.

Legislative and policy background

11.1.5 Key legislation relating to biodiversity and nature conservation and relevant to the scheme is detailed in *Appendix 11.11* and includes the following:

- *National Planning Policy Framework 2012* (NPPF) and the associated *National Planning Practice Guidelines 2014* (NPPG);
- *Conservation of Habitats and Species Regulations 2010* (as amended);
- *Wildlife & Countryside Act 1981* (as amended);
- *Natural Environment & Rural Communities Act 2006* (NERC);
- *Highways Agency Biodiversity Action Plan (BAP) (2002)* (currently under review);
- *Cambridgeshire and Peterborough BAP (2007)*; and
- *Department for Transport Draft National Policy Statement (NPS) for National Networks 2013*.

11.1.6 A review of local planning policy has identified the following planning policy issues of relevance to nature conservation:

- *Cambridge Local Plan 2006*:
 - Policy 3/9 Watercourses and Other Bodies of Water;
 - Policy 4/3 Safeguarding Features of Amenity or Nature Conservation Value;
 - Policy 4/4 Trees;
 - Policy 4/5 Protection of Sites of National Nature Conservation Importance;
 - Policy 4/6 Protection of Sites of Local Nature Conservation Importance;
 - Policy 4/7 Species Protection;
 - Policy 4/8 Local Biodiversity Action Plans; and
 - Policy 4/15 Lighting.
- North West Cambridge Area Action Plan (October 2009):
 - Policy NW2: Development Principles.
- The Cambridge Local Plan 2014: Proposed Submission:
 - Policy 69 Protection of Sites of Local Nature Conservation Importance; and
 - Policy 70 Protection of Priority Species and Habitats.

- South Cambridgeshire Development Control Policies (July 2007):
 - Policy NE/5 Countryside Enhancement Areas;
 - Policy NE/6 Biodiversity; and
 - Policy NE/7 Sites of Biodiversity or Geological Importance.
- The South Cambridgeshire Local Plan 2011-2031: Proposed Submission:
 - Policy NH/4 Biodiversity;
 - Policy NH/5 Sites of Biodiversity or Geological Importance;
 - Policy NH/6 Green Infrastructure; and
 - Policy NH/8 Ancient Woodland and Veteran Trees.
- *South Cambridgeshire Biodiversity Supplementary Planning Document* (2009):
- *Huntingdonshire Core Strategy* (September 2009):
 - Policy CS1 Sustainable Development in Huntingdonshire; and
 - Policy CS9 Strategic Green Infrastructure Enhancement.
- Saved policies from the *Huntingdonshire Local Plan 1995* and the *Local Plan Alteration 2002*:
 - Policy En18 Protection of Countryside Features;
 - Policy En19 Tree Preservation Orders;
 - Policy En22 Nature and Wildlife Conservation; and
 - Policy En23 Sites of Special Scientific Interest and National Nature Reserves.
- Huntingdonshire Draft Local Plan to 2036:
 - Policy LP1 Strategy and Principle for Development;
 - Policy LP7 Strategic Green Infrastructure Enhancement;
 - Policy LP28 Biodiversity and Protected Habitats and Species;
 - Policy LP29 Trees, Woodland and Related Features; and
 - Policy LP31 Heritage Assets and their Settings.

11.2 Method of assessment

Approach

- 11.2.1 A staged approach has been taken in assessing the ecological value of the study area. This involved an initial desk study and review of previous work undertaken in relation to the scheme prior to 2014, followed by subsequent detailed baseline field surveys and assessments as required. The results of these surveys, assessments and consultations form the basis of the detailed assessment presented in this chapter.
- 11.2.2 The impact assessment is based on a construction phase lasting approximately five years, with works commencing in early 2016. This would include phasing of the six different sections (*Chapter 3* and *Figure 3.1* for scheme sections) of the scheme, starting in early 2016 and ending in 2021. It is possible that some minor works, such as habitat establishment in some specific locations, may be undertaken in advance of 2016, but this would not affect the findings reported in this chapter.
- 11.2.3 The assessment takes a worst case scenario approach. The DCO boundary represents a likely worst case construction scenario for the temporary works footprint and mitigation is considered in relation to the certainty over long term management.
- 11.2.4 At this preliminary design stage of the scheme, the assessment of likely construction effects has been based upon the construction information provided within *Appendix 3.2*. For the purposes of this assessment, the likely worst case scenario assessed assumes that construction would be phased over the six different sections of the scheme, as presented in *Appendix 3.2*, starting in 2016 and ending in 2021. This is a reasonable assumption for this assessment because any seasonality of mitigation measures can be identified during detailed design and scheduled in appropriately. The effects of construction as reported in this chapter are not likely to change even if the envisaged sectional phasing of construction as set out in *Appendix 3.2* should change.
- 11.2.5 The baseline year of 2016 remains relevant across the construction programme, including section 6 which would not commence until the new route was operational, because the assessed conditions are not expected to change over the duration of the programme as presented in *Appendix 3.2*.

Guidance used

- 11.2.6 The chapter has been prepared in accordance with latest best practice guidance for ecological impact assessment and specifically the ecological assessment of road schemes:
- *DMRB. Volume 11, Section 3, Part 4* (Highways Agency, 1993).
 - *Interim Advice Note (IAN) 130/10* (Highways Agency, 2010). This document is supplementary to the extant (1993) advice provided in *DMRB. Volume 11, Section 3, Part 4* (Highways Agency, 1993).

- *CIEEM. Guidelines for Ecological Impact Assessment in the United Kingdom. (2006)*

11.2.7 Current best practice guidance documents for the survey and assessment of specific species and habitats has been used and are referenced in the appropriate technical appendices (*Appendices 11.1-11.10*).

Consultation and scoping

11.2.8 There has been a series of historical consultation and scoping exercises for earlier iterations of the scheme undertaken in 2007, 2009 and 2013. A history of the consultation process and responses associated with this project is provided in *Chapter 5* and the *A14 Cambridge to Huntingdon improvements scheme Consultation Report*.

11.2.9 A summary of key consultation and scoping activities undertaken for this scheme, and those responses most relevant to ecology and nature conservation, is given below:

- ecology baseline surveys consultation meeting with stakeholders (Bedfordshire, Cambridgeshire and & Northamptonshire Wildlife Trust; Cambridge County Council; South Cambridge District Council; Environment Agency) (December 2013);
- Planning Inspectorate (PINS) scoping consultation (March 2014);
- Highways Agency pre-application consultation (with scoping report and preliminary environmental information report) (April 2014);
- meeting with Natural England discretionary advice team - (April 2014); and
- bi-monthly Environmental Forum meetings.

11.2.10 Key responses in relation to ecology and nature conservation were received from:

- Cambridge County Council (CCC);
- Environment Agency;
- Forestry Commission;
- Huntingdon District Council (HDC);
- Natural England;
- Secretary of State Scoping Opinion, April 2014 (provided by PINS); and
- South Cambridgeshire District Council (SCDC).

11.2.11 In the context of this assessment, a number of the common themes picked up by consultees are summarised below in *Table 11.1*, together with the corresponding response to the comment and how it has been addressed as part of the EIA.

Table 11.1: Key themes of consultation responses 2014

Theme	Response/Action
Emphasis to provide net biodiversity gain	The scheme is designed in line with the requirements of the NPPF (2012) and the NERC Act 2006, which require the conservation and enhancement of biodiversity.
Ensure gaps in survey effort related to scheme changes between 2013 and 2014 are addressed.	The scope of survey work in 2014 has been designed to address gaps in survey coverage and changes in scheme design e.g. surveys for habitats and species of the A1 widening section between Alconbury and Brampton Hut (section 1).
Borrow pits are to be included in the assessment including proposals for restoration.	Borrow pits are considered within the ES. Details of habitat creation would be incorporated within the restoration design for each borrow pit.
The scheme should include measures to improve the existing situation regarding barriers to animal movement in the landscape.	The scheme design has been developed in accordance with an ecological mitigation strategy. Maintaining connectivity and key dispersal corridors is a central theme of the general design.
A Habitats Regulations Assessment Screening exercise should be carried out for Portholme Special Area of Conservation (SAC) and Eversden and Wimpole Woods SAC.	An Assessment for Implications on European Sites (AIES) has been produced in parallel to the ES, including consideration of both SACs highlighted (<i>Appendix 11.12</i>).
Letter of no impediment (Natural England) - Advice that Highways Agency will need to submit details equivalent to those required for a European protected species (EPS) licence application by development consent order application.	Following discussions between the Highways Agency, Natural England and The Planning Inspectorate, it is intended that this matter will be addressed by a Statement of Common Ground (SoCG) which details how the <i>Conservation of Habitats and Species Regulations 2010</i> (as amended) are being addressed in terms of Regulation 53 as part of the consenting process to ensure sufficient levels of detail are provided.
The assessment should take account of impacts on noise, vibration and air quality and cross reference should be made to these specialist reports.	Noted, cross-referenced and included in the assessment.

Consideration of a green bridge structure as part of the scheme

11.2.12 A written consultation response from CCC, (letter dated 7 March 2014) recommended that the scheme:

“must incorporate ways to alleviate effects of the A14 as a barrier for the movement of species across the landscape, for instance by provision of green bridges (e.g. Silver Street) and other crossing points (e.g. culverts).”

- 11.2.13 The ecological case for a green bridge at Silver Street has been considered in terms of the design mitigation but is not considered to be an appropriate mitigation option as discussed below.
- 11.2.14 The habitat in the location of Silver Street is intensive arable and there are not strong north-south linear habitat features e.g., watercourses, hedgerows, woodland, groups of trees or tree lines. Furthermore, as no significant bat roosts are located here, a green bridge is not required for mitigating habitat loss or severance impacts. The alternative measures of sensitive planting, fencing and lighting would mitigate impacts and bat hop-overs and tall screen planting to elevate flight paths for bats and barn owls are included either side of the road at this location.
- 11.2.15 Another species present (confirmed 2013-14) in the Silver Street area (section 3) is great crested newt (*Triturus cristatus*) (GCN) at ponds at Debden Top Farm and Lower Debden Farm (ponds 28, 32-34 *Figure 11.4*). The provision of a suitable crossing point in this area is important to maintain connectivity and support the metapopulation dynamics of newts using the ponds either side of the route. A suitably sited underpass is provided in this location and is considered more appropriate for this species. The use of an overbridge as opposed to a culvert would likely increase the risk of predation and death through exposure.
- 11.2.16 There is a known barn owl (*Tyto alba*) nest site in the vicinity of Silver Street bridge; such that it is considered to represent a potential mortality black spot for this species. To prevent this, shrub/tree vegetation is used in the design mitigation to elevate the owls' flight path above the traffic. Barn owls do not need a green bridge to achieve, this just sufficiently high vegetation either side of the road and an absence of grass verges to dissuade them from foraging by the road. Therefore a well-designed hop-over would benefit bats and barn owls at least as much as a green bridge.
- 11.2.17 There are no known badger (*Meles meles*) setts in the vicinity of this location so badgers would be unlikely to use a green bridge provided here.
- 11.2.18 Other locations where a green bridge may be ecologically appropriate have been considered e.g. an example of a known important flight route for bats where a green bridge may be of more value is the Hilton Road Bridge, however the large culvert proposed at this location is likely to be used by many bat species and is thus considered to provide suitable north-south connectivity.
- 11.2.19 Maintaining landscape and habitat connectivity has been a core aim of the design mitigation. This has been achieved largely via the use of appropriate habitat creation, landscaping, including tall screen planting, and the provision of suitably located and designed culverts. A green bridge is not thought to be of specific benefit to maintaining this connectivity.

Use of professional judgement

- 11.2.20 All field surveys were led by suitably qualified and experienced ecologists holding the relevant survey licences. Further details on the staff leading surveys can be provided on request including membership details of the

Chartered Institute of Ecology and Environmental Management (CIEEM) and relevant Chartership status (Chartered Ecologist CEcol/Chartered Environmentalist CEnv). Requests for these details should be made to the Highways Agency at the address given in *Chapter 1*.

11.2.21 All electric fishing surveys were undertaken by accredited and experienced surveyors working to the Environment Agency Code of Practice and under fisheries consent B/AC/12052014/C3.

11.2.22 *Appendix 6.1* lists principal authors and their qualifications.

The study area

11.2.23 The indicative extent of the scheme (the development consent order (DCO) boundary) is based on the November 2014 scheme design and a likely worst case construction scenario for the temporary works footprint. The aim would be to utilise land comprising habitats of low ecological diversity or value for construction requirements.

11.2.24 The ecological study area included the development footprint plus an appropriate ecological buffer that varies according to the spatial characteristics of each species or habitat potentially impacted (i.e. the ecological features). In each case, the aim has been to identify the likely zone of significant ecological influence that the scheme would have. This is informed by published guidance and the professional judgement of suitably qualified and experienced specialists. The distances the study area extends to for each ecological receptor are detailed in the appended technical reports (*Table 11.2* and *Appendices 11.1-10*).

Pre-existing information

11.2.25 Previous studies and baseline information for earlier iterations (pre-2013) of the scheme were collated and updated for this assessment. Whilst historical records have been included within this assessment for context, there is no reliance on information that may be considered out of date (pre-2013) within the conclusions of this report.

11.2.26 Desk study data to support the assessment have been provided by a number of sources including:

- Cambridge and Peterborough Biological Records Centre (CPBRC);
- The Environment Agency;
- Barn Owl Conservation Network;
- Cambridgeshire Mammal Group;
- Cambridgeshire Bat Group;
- British Trust for Ornithology (BTO); and
- Cambridgeshire and Peterborough Biodiversity Partnership (otter road traffic mortalities).

11.2.27 Specific ecological records relevant to the assessment are detailed in the technical appendices (*Appendices 11.1-11.10*) and these have been used

in the development of the field survey design and to place field survey results into context in respect of the impact assessment.

Field survey

11.2.28 The likelihood of a habitat and/or species to be present and affected by the scheme was identified by desk study, consultation and field survey. *Table 11.2* summarises the surveys carried out in 2013 and 2014 to establish an accurate baseline to inform a robust impact assessment. The results of the various field surveys undertaken are summarised in this chapter, with more detail provided in the following technical appendices:

- Phase 1 habitats (*Appendix 11.1*);
- aquatic invertebrates (*Appendix 11.2*);
- freshwater fish (*Appendix 11.3*);
- great crested newt (*Appendix 11.4*);
- reptiles (*Appendix 11.5*);
- birds (*Appendix 11.6*) (covers breeding and wintering birds);
- barn owl (*Appendix 11.7*);
- bats (*Appendix 11.8*);
- riparian mammals (*Appendix 11.9*) (covers water vole and otter);
and
- badger (*Appendix 11.10*).

11.2.29 The barn owl and badger appendices (*Appendix 11.7* and *Appendix 11.10*) are considered to hold ecologically sensitive information on protected species and are thus identified as confidential and not provided with the main ES. These appendices can be provided on request where appropriate.

11.2.30 Much of the 2014 survey work was to cover additional elements of the scheme, notably the widening of the A1 between Brampton Hut and Alconbury (section 1), plus any significant gaps in previous survey coverage elsewhere. Surveys to inform the EIA were focussed on features that were considered to be of at least local nature conservation value following a provisional ecological evaluation of features based on available pre-existing information (the Highways Agency EIA Scoping Report, 2014), or where information was required to ensure compliance with protected species legislation.

Table 11.2: Ecological survey for EIA

Receptor	Methodology	Survey area and date completed
Phase 1 habitats	<i>Handbook for Phase 1 habitat survey.</i> (Joint Nature Conservation Committee, 2010). (JNCC) 250m study area buffer	2013: Field survey of habitats along the scheme in June-October 2013 2013: Field survey of habitats between the Brampton Hut and Alconbury Junctions of the A1 (section 1) were undertaken in December 2013. <i>Figure 11.1</i> for survey area.
Aquatic Invertebrates.	<i>Council Directive (2000/60/EC) on a framework for the Community action in the field of water policy</i> (European Union, 2000), referred to as the Water Framework Directive (WFD) WFD UKTAG compliant kick samples (3 minute sweep plus hand search)	2013: West Brook, Washpit Brook and a tributary of West Brook 2014: Ten sites were chosen for survey based on main river WFD water bodies crossed by the scheme and tributaries of these waterbodies likely to be significantly altered, either as a result of diversion, culverting or increased input from road drainage. <i>Figure 11.2</i> for survey area.
Terrestrial Invertebrates	Walkover, sweep netting, branch beating, suction sampling, pitfall trapping <i>A14 Cambridge to Huntingdon Improvement Scheme; Terrestrial Invertebrate Survey Report.</i> (Highways Agency, 2013b)	2013: Walkover survey of the scheme (excluding the A1 widening, not part of the design at the time), species sampling at selected locations (sweep netting, beating, suction sampling) and pitfall trapping at a site of arable cultivation. Highways Agency (2013b)
Fish, including European eel	Environment Agency WFD compliant backpack electric fishing (x3 catch depletion method)	J2014: Surveys undertaken at 5/7 sites where watercourse would be crossed by the scheme or potentially affected by drainage design. At the additional two sites, fully quantitative surveys were not possible to access restrictions. <i>Figure 11.3</i> for survey area.

Receptor	Methodology	Survey area and date completed
Great Crested Newts (GCN)	<p>Habitat Suitability Index (HSI) <i>Evaluating the suitability of habitat for the great crested newt (Triturus cristatus)</i>. (Oldham, R.S. et al., 2000).</p> <p>Presence/Absence surveys. <i>Great Crested Newt Mitigation Guidelines</i>. (English Nature, 2001).</p>	<p>2013: Waterbodies within 500m of the offline scheme footprint and 250m of the online scheme footprint (excluding the A1 widening, not part of the design at the time) were subject to presence/absence survey.</p> <p>2014: Waterbodies within a 250m of the A1 from Alconbury to Brampton (section 1) and between Junctions 31-33 of the A14 widening (as not covered previously); plus those within a 500m of the offline section of the scheme that were previously not included in the 2013 survey work (due to not being identified or problems with access) were assessed for suitability to support GCN using HSI. Waterbodies providing suitable habitat for GCN were subject to presence/absence survey.</p> <p>Where GCN were found to be present in 2013 & 2014, an additional two surveys visits were undertaken to complete a population size class assessment.</p> <p><i>Figure 11.4</i> for survey area.</p>
Reptiles	<p>Artificial refuges <i>Survey protocols for the British herpetofauna</i>. (Sewell, D. et al., 2013).</p>	<p>2013: Survey of 13 sites along scheme footprint (pre-A1 widening).</p> <p>2014: Survey of four sites at A1 from Alconbury to Brampton (section 1) which would be widened and in areas along the length of the offline section of the A14 from Ellington to the A1 (section 2).</p> <p><i>Figure 11.5</i> for survey area.</p>
Birds (Breeding)	<p>Transect Based Common Bird Census (CBC), BTO Farmland Bird Survey methods. <i>Bird Census Techniques – Second Edition</i>. (Bibby, C. et al., 2000).</p>	<p>2013: Three sites; two areas of 'typical' arable farmland and the area comprising Buckden Gravel Pits County Wildlife Site (CWS)</p> <p>2014: 250m buffer around the A1 from Alconbury to Brampton (section 1) plus borrow pit areas.</p> <p><i>Figure 11.6</i> for survey area.</p>

Receptor	Methodology	Survey area and date completed
Birds (Wintering)	Day-time and night-time surveys. Multiple vantage-points survey and transect survey. <i>Winter Farmland Bird Survey</i> . (Gillings et al., 2008).	2012-2013: Surveys focussed on two distinct areas within the scheme footprint; farmland between Conington and Offord Cluny and a collection of gravel pits and grazing marsh and wetland habitat along the river Great Ouse north of Buckden Marina. 2013-2014: Two areas; the A14 widening section between Fenstanton and Girton and the A1 Alconbury to Brampton. <i>Figure 11.7</i> for survey area.
Barn owl	Onsite scoping, investigative field survey, nest site verification, emergence survey. <i>Barn Owl Tyto alba Survey Methodology and Techniques for use in Ecological Assessment: Developing Best Practice in Survey and Reporting</i> . (Shawyer, 2011).	2013: Within 1.5km of the 19km section of six-lane highway between Brampton and Fen Drayton and within a 200m buffer of the current 10km section of the A14 where new link roads would be constructed. 2014: 200m buffer around the A1 from Alconbury to Brampton section and a 1.5km survey buffer around the scheme footprint of the offline section of the A14 from Ellington to the A1. <i>Figure 11.8</i> for survey area.
Bats	Bat roost potential surveys (trees and structures), activity survey (transects and static monitoring), woodland backtracking surveys. <i>Bat Conservation Trust: Bat Survey, Good Practice Guidelines</i> . (Hundt, 2012).	2013: Summer & autumn transect (activity) surveys (x14), static (activity) monitoring (x38) and initial ground assessment of trees and buildings. 2014: Ground assessment of trees and structures (bridges, culverts buildings) within 100m of scheme. The 100m buffer did not include borrow pits where only trees within the borrow pit area and on the perimeter were assessed. Climbing of trees considered suitable to support roosting bats, dusk and dawn activity surveys of trees and structures. Woodland back tracking surveys (of woodland within 100m likely to be impacted). Manual transects and static monitoring for A1 from Alconbury to Brampton and to complete survey effort on the wider scheme where seasonal gaps existed due to access and other limitations. <i>Figures 11.9 and 11.10</i> for survey area.

Receptor	Methodology	Survey area and date completed
Water Vole and Otter	Presence/absence <i>Water vole conservation handbook, third edition</i> (Strachan et al., 2011). Otter: <i>Design Manual for Roads and Bridges, Volume 10, Environmental Design and Management, Section 4, Part 4 Nature Conservation (HA81/99) Nature Conservation Advice in Relation to Otters.</i> (Highways Agency, 2001).	2013: Both banks of all watercourses bisected by the scheme (pre-A1 widening) 250m up and downstream. 2014: Both banks of all watercourses bisected by the scheme between the Brampton Hut and Alconbury Junctions of the A1 (section 1) were surveyed up to 500m up and downstream. <i>Figure 11.11</i> for survey area.
Badger	All setts and signs of badger activity, including pathways, latrines and foraging evidence, were recorded onto field forms and mapped.	2013: Field survey of habitats in a 250m along the scheme in June-October 2013. 2014: Field survey of habitats between the Brampton Hut and Alconbury Junctions of the A1 (section 1) were undertaken in January 2014 in a buffer area of 30m plus a re-survey of all known setts within 100m of scheme in June & July (including borrow pits). <i>Figure 11.12</i> for survey area.

- 11.2.31 For watercourses, WFD assessment was undertaken in 2014. The WFD assessment aimed to determine the effects of the scheme on ecological quality, identifying any potential impacts that could cause deterioration in the assigned status of a waterbody and/or prevent a waterbody from meeting its WFD objectives. WFD assessment is covered in detail in *Chapter 17*.
- 11.2.32 Dormouse (*Muscardinus avellanarius*), brown hare (*Lepus europaeus*), common toad (*Bufo bufo*) and white-clawed crayfish (*Austropotamobius pallipes*) were scoped out of further survey work. In the case of dormice and crayfish, these species are known to be absent from areas to be impacted by the scheme.
- 11.2.33 The scoping out of further survey work for dormice was agreed with consultees (Bedfordshire, Cambridgeshire and Northamptonshire Wildlife Trust; Cambridge County Council; South Cambridge District Council; Environment Agency) at an ecological consultation session at SCDC offices on 3 December 2013. The only known population of dormice in the county is restricted to within Brampton Wood which lies 550m west of the scheme to which it is connected via a line of hedge with trees. This population is the result of a closely monitored reintroduction. Prior to introduction in Brampton Wood, there were no known records of dormice in the area. Dormice were introduced into Brampton Wood (1993/94) as part of a Natural England Species Recovery Programme. Survey work undertaken between 2007-2009, included the placing of dormouse nest tubes in potentially suitable hedgerows linked to Brampton Wood that would be crossed by the scheme. No dormice were recorded. Close monitoring of hedgerows leading out of Brampton Wood by the Bedfordshire, Cambridgeshire and Northamptonshire Wildlife Trust, indicate that expansion out of the wood has yet to occur. The size of the population in Brampton Wood was considered by the Wildlife Trust not sufficiently large for them to disperse into the surrounding hedgerows.
- 11.2.34 The scoping out of further survey work for white-clawed crayfish was likewise agreed with consultees at an ecological consultation session at SCDC offices on 3 December 2013. White-clawed crayfish are no longer present within the catchment. The Environment Agency confirmed there are no records of white-clawed crayfish within 2km of the scheme (Sarah Lamming, Environment Agency, pers. comm. 11 June 2013), with the nearest record being some 20km away.
- 11.2.35 As brown hare and common toad are known to be present within the study area and within the region in significant numbers, dedicated surveys for these receptors are not deemed necessary and their presence has been assumed. Furthermore any anecdotal records recorded during other surveys have been assessed in the EIA.
- 11.2.36 Incidental records were noted during all surveys and recorded within a database, which was then used within the evaluation and assessment of relevant ecological features. These records are captured within the relevant technical reports (*Appendices 11.1-11.10*).

Limitations

- 11.2.37 Any survey of flora and fauna will be unavoidably constrained in a number of respects. In an effort to mitigate those constraints, nationally recognised standard survey methodologies have been used to minimise these limitations for ecological evaluation and impact assessment.
- 11.2.38 Specific limitations relevant to each survey, such as access constraints, are detailed in the relevant technical reports (*Appendices 11.1-11.10*). It is not considered that any of these survey specific constraints represent a significant limitation to adequately assessing the value of ecological features for the purposes of undertaking a reasonable ecological impact assessment.
- 11.2.39 Ecological mitigation measures are described in this chapter and are shown in the ecological mitigation plans (*Figure 11.13*). The detailed design of some aspects of mitigation (such as mammal underpasses) would be developed during the detailed design phase. However, the impact assessment has taken account of the worst case scenarios and mitigation measures are included within the outline design accordingly.
- 11.2.40 At the current stage in the design process, there are necessarily some minor details yet to be confirmed of the permanent design and the temporary construction works which could have ecological impacts. However, these are unlikely to result in significant adverse ecological effects, as the potential design refinements would tend to reduce further and/or to avoid some of the impacts identified in this chapter rather than to increase them. Furthermore, where it is considered that the status of the feature/receptor is likely to be subject to change before construction commences, pre-construction surveys would be completed.

Assessment criteria

- 11.2.41 The impact assessment for biodiversity and nature conservation was carried out based on the *Guidelines for Ecological Impact Assessment in the United Kingdom* (CIEEM, 2006), *DMRB Volume 11, Section 3, Part 4* (Highways Agency, 1993) and *IAN 130/10*, (Highways Agency, 2010).
- 11.2.42 The starting point for any assessment of impacts is to determine which features should be subject to detailed assessment. This is done in conjunction with the scoping exercise. Ecological features to be subject to detailed assessment should be a) of sufficient value that impacts upon them may be significant (in terms of legislation or policy) and b) potentially vulnerable to significant impacts arising from the development. *Guidelines for Ecological Impact Assessment in the United Kingdom* (CIEEM, 2006). This approach is consistent with EIA Regulations and the NPPF (2012), which requires investigation of likely significant effects.

11.2.43 In accordance with *DMRB, Volume 11, Section 2, Part 6 (HD48/08) Reporting of Environmental Impact Assessments* (Highways Agency, 2008), there are a number of ways in which the information on baseline conditions, mitigation and predicted effects can be presented. This is in terms of whether to present these all individually, i.e. baseline, potential impacts, mitigation and residual effects after mitigation, or whether to take into account mitigation before predicting effects. For large projects, or ones with a number of significant effects, taking each section individually can make an assessment long and difficult to interpret. This chapter takes the approach of covering all the baseline condition information together in one section, and then considers the proposed mitigation and residual effects after mitigation for each topic in turn.

Determining value

11.2.44 Ecological features were evaluated based on criteria outlined in *IAN 130/10* (Highways Agency, 2010), and by current good ecological practice detailed in the *Guidelines for Ecological Impact Assessment in the United Kingdom* (CIEEM, 2006).

11.2.45 This method required the allocation of a geographical level of value to each receptor based on that receptor's status uninfluenced by any 'value' afforded to it by its legal protection. In most cases this is qualified by an understanding of how the potentially affected population or habitat contributes to the receptor's conservation status or distribution at that geographical scale.

11.2.46 The potential levels of value to be assigned to features are:

- international (Europe);
- national (UK);
- regional (East of England);
- county (Cambridgeshire);
- district (i.e. South Cambridgeshire, Huntingdonshire);
- local (of approximate parish scale); and
- site only (immediate vicinity of scheme).

11.2.47 Evaluation criteria used are summarised in *Table 11.3*. Factors included in the evaluation include the level of designation for designated sites and in relation to species, distribution and status, including a consideration of trends based on available historical records. Details of the exact method and criteria used for each ecological receptor are provided in the relevant technical reports (*Appendices 11.1-11.10*).

11.2.48 Impact assessment was only carried out on those features determined to have at least local value.

Table 11.3: Resource valuation (taken from IAN 130/10 (Highways Agency, 2010))

International or European value
<p>Natura 2000 sites including: Sites of Community Importance (SCIs); Special Protection Areas (SPAs); potential SPAs (pSPAs); 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. Resident, or regularly occurring, populations of species which may be considered at an International or European level where:</p> <ul style="list-style-type: none"> • 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.
UK or national value
<p>Designated sites including: SSSIs; Marine Protected Areas (MPAs) including Marine Conservation Zones (MCZs); and National Nature Reserves (NNRs). Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key/priority habitats identified in the UK BAP, including those published in accordance with Section 41 of the Natural Environment and Rural Communities Act (2006) and those considered to be of principal importance for the conservation of biodiversity. Areas of Ancient Woodland e.g. woodland listed within the Ancient Woodland Inventory. Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level where:</p> <ul style="list-style-type: none"> • 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.
Regional value
<p>Areas of key/priority habitats identified in the Regional BAP (where available); areas of key/priority habitat identified as being of Regional value in the appropriate Natural Area Profile (or equivalent); areas that have been identified by regional plans or strategies as areas for restoration or re-creation of priority habitats (for example, South West Nature Map); and areas of key/priority habitat listed within the Highways Agency's BAP (HABAP). Resident, or regularly occurring, populations of species which may be considered at an International, European, UK or National level and key/priority species listed within the HABAP where:</p> <ul style="list-style-type: none"> • the loss of these populations would adversely affect the conservation status or distribution of the species at this scale; or • the population forms a critical part of a wider population; or • the species is at a critical phase of its life cycle.

County or unitary authority area value

Designated sites including: Sites of Nature Conservation Importance (SNCIs); County Wildlife Sites (CWSs); and Local Nature Reserves (LNRs) designated in the county or unitary authority area context. Areas which meet the published selection criteria for those sites listed above but which are not themselves designated as such. Areas of key/priority habitats identified in the Local BAP; and areas of habitat identified in the appropriate Natural Area Profile (or equivalent). 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 unitary authority area; or
- the population forms a critical part of a wider population; or
- the species is at a critical phase of its life cycle.

Local value

Designated sites including: LNRs designated in the local context. Trees that are protected by Tree Preservation Orders (TPOs). Areas of habitat; or populations/communities of species 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.

Characterisation of ecological effects

11.2.49 In accordance with *Table 2: Characterisation of Ecological Impacts in IAN 130/10* (Highways Agency, 2010), significant effects were categorised including the following as appropriate:

- Sign: Positive (Beneficial (+ve)) or negative (adverse (-ve)).
- Probability of occurring: Certain, probable, unlikely.
- Complexity: Direct, indirect, cumulative.
- Extent: Area measures and percentage of total (e.g. area of habitat/territory lost).
- Size: Description of level of severity of influence (e.g. complete loss, number of animals affected).
- Reversibility: Reversible or not reversible (can the effect be reversed, whether or not this is planned).
- Duration: Permanent or temporary in ecological terms. Where differing timescales are determined in relation to the life-cycle of the receptor, these should be defined.
- Timing and frequency: Important seasonal and/or life-cycle constraints and any relationship with frequency considered.

11.2.50 Both direct and indirect effects are considered:

- Direct effects are changes directly attributable to a defined action such as the physical loss of a habitat or the immediate mortality of an individual of a particular species.
- Indirect effects are attributable to an action, but which affect ecological resources through impacts on an intermediary ecosystem, process or receptor. An example of this would be an impact on an aquatic species located downstream of the site due to polluted runoff from construction entering the river catchment.

Determining significance of effects on conservation status

11.2.51 In accordance with the *Guidelines for Ecological Impact Assessment in the United Kingdom* (CIEEM, 2006) a significant effect, in ecological terms, was defined as an impact (adverse or positive) on the integrity of a defined site or ecosystem(s) and/or the conservation status of habitats or species within a given geographical area. Significance of effects was assigned in accordance with the criteria in *IAN 130/10* (Highways Agency, 2010), which is reproduced below in *Table 11.4* and provides an approach to relate effects on features at different levels of value to significance categories used by other topic areas which will be used in this assessment. As illustrated in *Table 11.4* effects categorised as 'large' and 'very large' are those which are likely to be key factors in the decision making process.

Table 11.4: Significance of effects

Significance category	Typical descriptions of effect (nature conservation)
Very Large	An effect on one or more receptor(s) of international, European, UK or national value. NOTE: only adverse effects are normally assigned this level of significance. They should be considered to represent key factors in the decision-making process.
Large	An effect on one or more receptor(s) of regional value. NOTE: these effects are considered to be very important considerations and are likely to be material in the decision-making process.
Moderate	An effect on one or more receptor(s) of county or unitary authority area value. NOTE: these effects may be important, but are not likely to be key decision-making factors.
Slight	An effect on one or more receptor(s) of local value. NOTE: these effects are unlikely to be critical in the decision-making process, but are important in enhancing the subsequent design of the project.
Neutral	No significant effects on key nature conservation features. NOTE: absence of effects, or those that are beneath levels of perception.

- 11.2.52 For the purposes of this EIA an effect is considered to be significant if it is moderate or greater (see paragraph 6.9.8 in *Chapter 6*).
- 11.2.53 Effects on conservation status were only assessed in detail for features of sufficient value (local or above) that impacts upon them may be material in decision-making in terms of legislation or policy. Effects on features below local value would be categorised as of neutral significance.
- 11.2.54 Any significant effects remaining after mitigation (the residual effects), together with an assessment of the likelihood of success in the mitigation, are factors to be considered against legislation, policy and development control in determining the application.

Mitigation, compensation and enhancement

- 11.2.55 It is important as part of any EIA, wherever possible, to clearly differentiate between mitigation, compensation and enhancement and these terms are defined here as follows:

- Mitigation is used to refer to measures to avoid, reduce or remedy a specific negative impact in situ. Mitigation is only required for negative effects assessed as being significant or where required to ensure compliance with legislation.
- Compensation is used to refer to measures proposed in relation to specific negative effects but where it is not possible to fully mitigate for negative effects in situ. Compensation is only required for negative effects assessed as being significant or where required to ensure compliance with legislation.
- Enhancement is used to refer to measures that would result in positive ecological impacts but which don't relate to specific significant negative effects or where measures are required to ensure legal compliance.

Protected species legislation

- 11.2.56 This chapter focusses on how the scheme may impact upon the nature conservation status of relevant habitats and species. Additional detail relating to the actions required to ensure legislative compliance in relation to species protected under the *Wildlife and Countryside Act 1981 (as amended)* and *Conservation of Habitats and Species Regulations 2010 (as amended)*, is provided in *Appendix 11.11*.
- 11.2.57 For reptiles and badger, where the value of these species is considered only to be site level (*Table 11.17*) all mitigation is therefore in *Appendix 11.11* and a detailed impact assessment is not carried out for these species.

11.3 Baseline conditions

- 11.3.1 This section summarises the existing ecological features within the study area as they are currently understood and the value of those features. Detailed desk study and survey results plus the evaluation of features is

provided within specific technical reports for each receptor (*Appendices 11.1-11.10*).

Ecological baseline

Statutory and non-statutory designated sites

- 11.3.2 A summary of statutory designated sites considered to have the potential to be impacted by the scheme is provided below in *Table 11.4*. Further information on European sites is provided in *Appendix 11.12*. As agreed in consultation with Natural England and the Planning Inspectorate, the AIES considers Portholme Special Area of Conservation (SAC) which lies within 70m of the scheme, in addition to the Ouse Washes SAC/Special Protection Area (SPA)/Ramsar site which lies 9.3km to the north-east and Eversden and Wimpole Woods SAC which lies 9.6km south-west of the scheme (see *Figure 11.14*). The Ouse Washes SAC/SPA/Ramsar is included in the assessment as it is hydrologically linked to the scheme via the river Great Ouse. Eversden and Wimpole Woods SAC is included in the assessment as it is designated for the barbastelle bat (*Barbastella barbastellus*) which is a mobile species which could be impacted by changes in landscape which are distant from the boundaries of the SAC.
- 11.3.3 To determine those SSSIs requiring inclusion in the assessment, Natural England's Impact Risk Zones (IRZs) dataset has been used. This is a GIS tool which maps zones around each SSSI according to the particular sensitivities of the features for which it is notified and specifies the types of development that have the potential to have adverse impacts¹. SSSIs with IRZs overlapping the scheme which are relevant to the development (i.e. IRZs identifying zones which need to be assessed in relation to all planning applications or more specifically infrastructure projects) are those identified in *Table 11.5*.
- 11.3.4 A summary of non-statutory sites, including CWS, City Wildlife Sites (CiWS) and Protected Roadside Verges (PRVs) designated for nature conservation importance within 2km of the scheme is provided in *Table 11.6*.
- 11.3.5 The only designated site to be directly affected in terms of land loss is the Buckden Gravel Pits CWS which would be crossed by a viaduct/bridge for the new offline Huntingdon Southern Bypass (section 2). The River Great Ouse CWS would be crossed by a bridge/viaduct in this same location but would not suffer any direct land take.

¹ <http://www.naturalengland.org.uk/ourwork/planningdevelopment/impactriskzonesgistoolfeature.aspx>

Table 11.5: Statutory designated sites of nature conservation importance with potential to be adversely affected by the scheme

Site name	Designation	Distance from scheme works	Direction from scheme footprint	Reason(s) for designation
Brampton Meadow	SSSI	0m	South	Species-rich calcareous grassland with quaking grass, adders-tongue plus green-winged orchids and meadow saxifrage.
Portholme	SAC, SSSI	35m from SAC/11m from SSSI	North	The largest surviving traditionally-managed lowland hay meadows in the UK. MG4 BAP Priority habitat supporting a small population of fritillary (<i>Fritillaria meleagris</i>)
Brampton Wood	SSSI	550m	West	Wet, ash-maple woodland including wild pear. Woodland rides supporting species-rich neutral grassland flora uncommon in the county
Brampton Racecourse	SSSI	705m	East	Species-rich neutral grassland including presence of saw-wort and green-winged orchid.
Madingley Wood	SSSI	1,175m	south-west	Ancient ash-maple woodland characteristic of eastern England.
Little Paxton Pits	SSSI	3,000m	South	Little Paxton Pits is an extensive area of flooded gravel workings of varied age, with a correspondingly diverse vegetation structure. The pits are of national importance for wintering wildfowl and an important stopping point for migrants. The invertebrate fauna is extremely rich and includes a number of national rarities.
St Neots Common	SSSI	6,900m	South	This riverside common holds alluvial grassland and associated ponds, ditches and willow carr which together provide an area of diverse wildlife habitat supporting a variety of species.
Ouse Washes	SAC, SPA, Ramsar, SSSI	9,300m	north-east	The SAC is cited for the spined loach (<i>Cobitis taenia</i>). The SPA/Ramsar designations recognise that the washlands support nationally and internationally important numbers of wintering waterfowl and nationally important numbers of breeding waterfowl.

Site name	Designation	Distance from scheme works	Direction from scheme footprint	Reason(s) for designation
Eversden and Wimpole Woods	SAC, SSSI	9,600m	south	Eversden Wood is an important ancient semi-natural woodland of a type now localised in extent, and rare in lowland England. The habitats present support a nationally important summer maternity roost for the barbastelle bat.

Table 11.6: Non-statutory designated sites of nature conservation importance within 2km of the site

Site Name	Designation	Distance from scheme works	Direction from scheme footprint	Reason(s) for designation (where known)
Buckden Gravel Pits	CWS	Crossed by scheme	Crossed by scheme	Habitat mosaic with semi- improved grassland, swamp vegetation, open water (standing and flowing) and hedgerows.
River Great Ouse	CWS	To be bridged by new viaduct	To be bridged by new viaduct	Major river, not grossly modified by canalization or poor water quality. Supports a mosaic of wetland habitats including swamp and National Vegetation Classification (NVC) MG13 neutral grassland.
Fenstanton Pits (West End Pits)	CWS	Scheme encroaches on south west corner	north	The site qualifies as a CWS as a Grade C site in the JNCC Invertebrate Site Register. Supports breeding populations of at least 12 dragonfly species.
Madingley Brick Pits	CWS	0m (adjacent)	south	Supports a rare liverwort.
Brampton Road A1 Slip Road	CWS	75m	south	Neutral grassland.
Park Road Grasslands	CWS	150m	east	Important hedgerow.
Hinchingbrooke Gravel Pits	CWS	250m	south	Supports mature trees, scrub, hedgerows, marshy grassland, swamp and open water.

Site Name	Designation	Distance from scheme works	Direction from scheme footprint	Reason(s) for designation (where known)
Brampton Flood Meadows	CWS	370m	north	BAP Priority neutral grassland (NVC MG4). The site is also important for invertebrates and a population of greater spearwort.
Settling Bed (East of Silver Street)	CWS	580m	south-west	Reed swamp.
West Meadow	CWS	700m	south	BAP Priority neutral grassland (NVC MG4).
Lattenbury Hill Parkland	CWS	750m	south	Pasture woodland with an average of more than five mature and over-mature trees per hectare.
Mere Lane (East) RSV	CWS	880m	west	Neutral grassland.
Marsh Lane Gravel Pits	CWS	980m	north	Important site for invertebrates. Supports breeding populations of at least 12 dragonfly species.
Fenstanton Meadow	CWS	1,150m	north	BAP Priority neutral grassland (NVC MG4 & MG5).
Woolley Leys RSV	CWS	1,300m	west	Supports frequent numbers of at least eight neutral grassland indicator species; one of these is a species rare in the county.
River Cam	CWS	1,300m	east	Wetland habitat with adjacent semi-natural habitats. Pollarded willows.
Littlebury Farm Meadows	CWS	1,500m	north	BAP Priority grassland (NVC MG5).
Fen Drayton Gravel Pits	CWS	1,500m	north	Supports a population of a Nationally Scarce vascular plant species (<i>Cuscuta europaea</i>).
Low Meadows (West)	CWS	1,600m	north	BAP Priority grassland (NVC MG5).
Hermitage Wood	CWS	>2,000m	north-east	Woodland listed in the Cambridgeshire Inventory of Ancient Woodland which retains more than 25% semi-natural cover.

Site Name	Designation	Distance from scheme works	Direction from scheme footprint	Reason(s) for designation (where known)
Ellington Pastures and Underlands	CWS	>2,000m	south-west	BAP Priority neutral grassland (NVC MG5).
King's Hedges Hedgerow	CiWS	100m	south	Important hedgerows.
Milton Road Hedgerows	CiWS	425m	south-east	Ecologically valuable hedgerow.
Ascension Parish Burial ground	CiWS	1,710m	south	Supports two or more strong neutral grassland indicator species in frequent numbers.
Bird Sanctuary, Conduit Head	CiWS	1,800m	south	Wetland habitats and woodland. Also supports great crested newts.
Scrub East of M11 Verge	CiWS	2,000m	south	Scrub and hedgerow.
Alconbury	PRV	800m	west	Neutral/calcareous grassland.
Brampton Road East	PRV	880m	west	Neutral/calcareous grassland.

Phase 1 habitats

Desk study results

- 11.3.6 Eleven records for notable, rare or scarce plants were reported by Cambridge & Peterborough Environmental Records Centre (CPERC). Most of these records were more than 30 years old and only two species records were reported within the last 11 years. None of the 11 notable, rare or scarce species identified in the biological records were recorded during the Phase 1 habitats surveys in 2013 & 2014.

Field survey results (2013 & 2014)

- 11.3.7 *Figure 11.1* illustrates the Phase 1 habitats recorded within the survey areas. The majority of the study area was dominated by arable land and fields were generally bounded by a mixture of species-poor intact hedges and/or ditches.
- 11.3.8 The study area comprised large expanses of regularly cultivated land growing a range of arable crops mainly cereals and oilseed rape. Many of these arable fields also had 6m sown grass margins (mostly species-poor semi-improved grassland dominated by grasses) around the field edges.
- 11.3.9 Cattle grazed pasture was prevalent towards the western end of the scheme between the river Great Ouse and the East Coast mainline railway east of Buckden Marina. Further small areas of grassland (some grazed by sheep, cattle and horses) were scattered throughout the study area including the Equestrian Centre near Wood Green Animal Shelter, Fenstanton, Swavesey, Conington, Girton and Milton.
- 11.3.10 Most of the grassland recorded in the study area, outside the designated sites, was species-poor and/or improved with only small areas of semi-improved neutral grassland present. The largest area of species-rich grassland was associated with Portholme SAC/SSSI south of Huntingdon.
- 11.3.11 The majority of woodland within the study area comprised small blocks (<2ha) of plantation broadleaved woodland. There were also areas of mixed woodland and semi-natural broad-leaved woodland.
- 11.3.12 The dominant canopy species in the broadleaved woodland blocks included pedunculate oak (*Quercus robur*), ash (*Fraxinus excelsior*) and field maple (*Acer campestre*) with occasional other species including sycamore (*Acer pseudoplatanus*), white poplar (*Populus alba*), English elm (*Ulmus procera*), wych elm (*Ulmus glabra*) and alder (*Alnus glutinosa*).
- 11.3.13 Ground flora in all the woodland blocks was sparse and generally species-poor, comprising common grasses, common nettle (*Urtica dioica*), ivy (*Hedera helix*), wood dock (*Rumex sanguineus*), ground ivy (*Glechoma hederacea*) and lesser celandine (*Ranunculus ficaria*). Ancient woodland indicator species were uncommon generally, with the exception of occasional records of ubiquitous species such as lords and ladies (*Arum maculatum*), wood avens (*Geum urbanum*) and wood brome (*Bromus sylvaticus*).

- 11.3.14 Scattered throughout the study area were numerous waterbodies including lakes, rivers, streams, ponds and ditches.
- 11.3.15 Large standing water bodies included gravel pits at Brampton Racecourse, Lenton Fishing Lakes, Fenstanton Gravel Pits, Buckden Gravel Pits, the Holiday Inn lake at Histon and lakes at Milton Country Park. The majority of these lakes were surrounded by either semi-improved neutral grassland and/or willow carr with some mature trees such as crack willow (*Salix fragilis*). There was minimal aquatic vegetation present although common reed (*Phragmites australis*) was a feature in some of these, forming dense areas of reed bed.
- 11.3.16 There were more than 150 ponds within the study area. Most of these were typical farm ponds, at least 100m² in size, although some were smaller with a tendency to dry out. There were also a number of these ponds which were typical balancing ponds constructed as part of existing highways schemes. These tended to be dominated by emergent vegetation such as common reed and reedmace and many had little open water.
- 11.3.17 There were over 200 ditches within the study area. The majority of these were typical arable field drains with steep banks (45° or in some cases steeper) and narrow watercourses (250mm or less). Most were dry in 2013. A significant number of the ditches surveyed were dry in April and May 2014 or were rapidly drying out.
- 11.3.18 Three invasive species listed on *Schedule 9 of the Wildlife and Countryside Act 1981 (as amended)* were recorded in the study area. New Zealand pigmyweed (*Crassula helmsii*) was found in three ponds (ponds B3d, B3dii & B3e (Highways Agency, 2013a)) at Cambridge Business Park, in a pond on the Dry Drayton interchange (Pond D14 (Highways Agency, 2013a)) and at Buckden Gravel Pits CWS. Two stands of Japanese knotweed (*Fallopia japonica*) were recorded during the course of the surveys. A small stand of Japanese knotweed was recorded beside a farm track on land south of the Histon interchange (TL 544218 261604). A second stand was noted growing in a southbound layby of the A1 (TL 19258 73340). There were various records of Canadian pondweed (*Elodea canadensis*) within the study area.
- 11.3.19 Table 11.7 summarises the habitats recorded and their priority status.

Table 11.7: Habitats recorded and priority status

Habitat	Section 41	Highways Agency BAP	C&PLBAP*
Broadleaved woodland-semi-natural	Y	Y	Y
Broadleaved woodland-plantation		Y	
Coniferous woodland-plantation			
Mixed woodland-plantation		Y	
Trees		Y	Y
Scrub		Y	
Hedges, species-poor intact	Y	Y	Y
Hedge with trees	Y	Y	Y
Defunct hedge, species-poor	Y	Y	Y
Running water-rivers and streams/brooks	Y		Y
Standing water-lakes, ponds and reservoirs	Y	Y	Y
Dry ditches		Y	Y
Wet ditches		Y	Y
Swamp, marginal and inundation			
Arable	Y (field margin)		Y
Poor semi-improved grassland		Y	
Semi-improved grassland-neutral		Y	
Amenity grassland			Y
Improved grassland			
Tall ruderal			
Bare ground			
Hardstanding			

*Cambridge & Peterborough Local Biodiversity Action Plan

Aquatic invertebrates

Desk study results

11.3.20 Three of the watercourses crossed by the scheme (Cottenham Lode, Swavesey Drain and the river Great Ouse) have been classified for aquatic invertebrates under the WFD (*Table 11.8 and Figure 11.2* for survey locations). Cottenham Lode is classified as high quality for aquatic invertebrates, indicating that the invertebrate community is in reference condition, and therefore unaffected by human intervention. Slight deviation from reference condition results in good quality classifications for Swavesey Drain and the river Great Ouse. The sites on the Alconbury and Brampton Brook and the Ellington Brook are classified at moderate quality for invertebrates.

- 11.3.21 Of the watercourses listed in *Table 11.8* all but Swavesey Drain are classified as highly modified waterbodies (HMWB) under the WFD.
- 11.3.22 The Environment Agency provided data for a single site (Grindleys Bridge, Alconbury Brook, TL 19200 73100) that falls within the buffer zone of the current scheme, and biological metrics for this site are shown in *Table 11.9*.

Table 11.8: WFD invertebrate classification for WFD waterbodies crossed by the scheme

WFD water body	WFD reference	Invertebrate classification
Cock Brook	GB105033042810	Not designated
Alconbury and Brampton Brook	GB105033042790	Moderate
Ellington Brook	GB105033042840	Moderate
River Ouse	GB105033047921	Good
West Brook	GB105033042730	Not designated
Swavesey Drain	GB105033042770	Good
Cottenham Lode	GB105033043320	High

Table 11 .9: Historic Environment Agency aquatic invertebrate data

Site / waterbody	Date	BMWP	ASPT	nTaxa
Alconbury Brook	1984 -2011	37 - 141	4.7 – 4.83	10 - 30

- 11.3.23 *Valvata macrostoma*, a Red Data Book (RDB) 2 (Vulnerable) species was recorded twice at Grindleys Bridge during routine Environment Agency sampling in 1993. A further four species of conservation interest (Local or above) were recorded between 1996 – 2003, including the aquatic snail *Bithynia leachi* and three species of aquatic beetles; *Gyrinus urinator*, *Nebrioporus depressus* and *Hydraena palustris*.
- 11.3.24 Aquatic invertebrate data was collected in 2013 from West Brook, Washpit Brook and Tributary of the West Brook (nine samples in total). This data indicated that observed habitat modification and poor habitat quality were factors in limiting the ecological potential of these three watercourses.
- 11.3.25 A single, signal crayfish (*Pacifastacus leniusculus*) was recorded in the Cambridge Reservoir during a night-time bat survey. A number of signal crayfish were also reported from still waters as part of the 2013 GCN surveys.

Field survey results (2014)

11.3.26 *Table 11.10* indicates that the aquatic invertebrate community reached good quality on the Ellington Brook only during 2014. Quality was driven by diversity and pollution sensitivity metrics. Moderate aquatic invertebrate quality was observed at five sites, with water quality driving classification at both sites on the Alconbury and Brampton Brooks, whilst diversity was limiting the observed communities on the West Brook. Three sites recorded poor quality for aquatic invertebrates. At Catch Hall Farm and Conington Road the site classification was determined by poor water quality, whilst on the West Brook tributary, diversity was classified as bad, reducing the classification.

Table 11.10: WFD classifications of watercourses surveyed in 2014

Site	WFD class
D/S Footbridge: Alconbury & Brampton Brooks	Moderate
Matcham Bridge: Alconbury & Brampton Brooks	Moderate
Ellington Brook U/S A1: Ellington Brook	Good
West Brook B1040*: West Brook	Moderate
Catch Hall Farm: Cottenham Lode	Poor
Thorpes Farm: Swavesey Drain	Moderate
Conington Road: Unnamed tributary of Fen Drayton	Poor
Washpit Brook: Tributary of Cottenham Lode	Moderate
West Brook Tributary*: Unnamed tributary of West Brook	Poor

* spring survey season only

11.3.27 Lotic Invertebrate Flow Evaluation (LIFE) scores for all sites were within the range expected from low gradient drainage channels and lowland rivers. The highest LIFE Ecological Quality Ratio (EQR) was observed on the West and Ellington Brook, whilst the lowest LIFE EQR was recorded on the West Brook tributary and Conington Road. The low LIFE EQRs were associated with ditch or slack flow type habitats.

11.3.28 The Ellington Brook and D/S Footbridge (Alconbury and Brampton Brook) sites demonstrate 'fairly high' conservation value, indicating a site supporting at least one uncommon species, several species of restricted distribution or a community of high taxon richness.

11.3.29 Matcham Bridge (Alconbury and Brampton Brook), Thorpes Farm (Swavesey Drain) and Washpit Brook demonstrate moderate conservation value, supporting at least one species of restricted distribution or a community with moderate taxon richness.

Species of conservation interest

11.3.30 Four species of conservation interest were recorded from five sites during the 2014 aquatic invertebrate surveys. A single species, *Enochrus melanocephalus* is reported as 'Notable', whilst the remaining three species are characterised as 'Local' (Table 11.11).

Table 11.11: Species of conservation interest recorded at aquatic invertebrate survey sites in 2014

Site	Species	Conservation value
Matcham Bridge	<i>Erpobdella testacea</i>	Local
	<i>Bithynia leachii</i>	Local
D/S footbridge	<i>Enochrus melanocephalus</i>	Notable
	<i>Erpobdella testacea</i>	Local
Ellington Brook (0.85km U/S A1)	<i>Erpobdella testacea</i>	Local
	<i>Notonecta viridis</i>	Local
Thorpes Farm	<i>Erpobdella testacea</i>	Local
Washpit Brook	<i>Erpobdella testacea</i>	Local

11.3.31 *Enochrus melanocephalus* is associated with richly vegetated habitats and has previously been recorded from Cambridgeshire. The three species of local conservation interest have all been reported previously from Cambridge.

11.3.32 No species listed under the Cambridgeshire or Peterborough LBAP or Section 41 of the NERC 2006 Act were recorded from the study area.

Terrestrial invertebrates

11.3.33 Surveys carried in 2010 informed the location of survey effort in 2013. The results of these surveys indicate that the site, as a whole, is of relatively low value for invertebrates *A14 Cambridge to Huntingdon Improvement Scheme; Terrestrial Invertebrate Survey Report* (Highways Agency, 2013b) and no additional survey was considered necessary in 2014.

11.3.34 No invertebrate species that are afforded direct legal protection under any UK or European legislation were encountered during the surveys carried out in 2010 & 2013.

11.3.35 A single Section 41 listed species was identified during the 2013 surveys. The white-spotted pinion moth *Cosmia diffinis* is a resident, breeding species on the elm trees at and near to the Wood Green Animal Shelter (section 3). It is strictly associated with English elm and is geographically restricted.

11.3.36 No species listed in the *British Red Data Books* (Shirt, 1987; Bratton, 1991) or which have been elevated to the status of Critically Endangered, Endangered, Nationally Vulnerable or Near Threatened (formerly Nationally Rare) by subsequent formal reviews was recorded.

- 11.3.37 Eight of the species recorded are categorised as 'Nationally Scarce'. The hornet clear wing moth (*Sesia apiformis*) feeds, as a caterpillar, under the bark at the base of black poplar and hybrid black poplar trees. The moth breeds in poplar trees to the east of the existing carriageway at the B1514 road junction (section 2). The additional seven Nationally Scarce species were all recorded in the wetland area at Buckden Gravel Pits, suggesting that this area has a comparatively high invertebrate value compared to the majority of the site.
- 11.3.38 Thirty-two of the recorded species are listed formally as 'Nationally Scarce'.
- 11.3.39 Based on the 2013 survey results, four very localised areas were identified as having invertebrate interest:
- a mature oak tree at TL 283 677;
 - the mature oak tree at Brampton Park /A1 junction (TL 198 699);
 - elm trees south of Wood Green Animal Shelter (TL 264 677); and
 - wetland & riparian vegetation in the vicinity of Buckden (TL 21 68).

Fish

Desk study results

- 11.3.40 Three of the watercourses crossed by the scheme have been classified for freshwater fish under the WFD (*Figure 11.3* for survey locations). The river Great Ouse and Swavesey Drain are classified as good quality for fish, indicating that the composition, abundance and age structure of fish communities show a slight deviation from reference condition. The Alconbury and Brampton Brook is classified as poor quality for fish, indicating a significant deviation from reference condition.
- 11.3.41 Environment Agency data indicate a mixed Cyprinidae community from the sites within the buffer zone. This is typified by the mix of both lentic and lotic cyprinid species across the varying size water bodies. The Environment Agency data includes records of bullhead (*Cottus gobio*), European eel (*Anguilla anguilla*) and spined loach (*Cobitis taenia*) both of which receive protection under European and national legislation.
- 11.3.42 Incidental fisheries data were gathered during GCN surveys undertaken in 2013 and invertebrate sampling on riverine sites during 2014. A wide diversity of fish was reported from still waters and ditch habitats within the study area. With the exception of rainbow trout (*Oncorhynchus mykiss*), all of the other freshwater fish species recorded would be expected from the wider environment. Rainbow trout, a non-native species, is a recreational species introduced into lakes for recreational angling.
- 11.3.43 The river Great Ouse was not sampled as part of this study due in part to the clear span crossing of the watercourse by the scheme and the technical difficulties in accurately assessing a watercourse of this size.

11.3.44 Studies quoted within *Microhabitat use and diet of 0+ cyprinid fishes in a lentic, regulated reach of the River Great Ouse, England* (Garner, 2006) indicate a numerical dominance of roach (*Rutilus rutilus*) within the main stem of the river Great Ouse, whilst the side tributaries are dominated by minnow (*Phoxinus phoxinus*). Reductions in fish diversity are attributed to habitat degradation and loss/fragmentation of suitable habitat, particularly for juvenile fish and a lack of suitable prey, resulting in slow growth patterns.

Field survey results (2014)

11.3.45 Freshwater fish were recorded from all of the five sites (*Figure 11.3*) monitored, the species observed being typical of lowland freshwater environments. Seven hundred and ninety-three individuals, representing 12 species, were recorded:

- three spined stickleback (*Gasterosteus aculeatus*);
- nine spined stickleback (*Pungitius pungitius*);
- bullhead (*Cottus gobio*);
- chub (*Squalius cephalus*);
- European eel (*Anguilla anguilla*);
- perch (*Perca fluviatilis*);
- pike (*Esox lucius*);
- roach (*Rutilus rutilus*);
- ruffe (*Gymnocephalus cernua*);
- spined loach (*Cobitis taenia*);
- stone loach (*Barbatula barbatula*); and
- tench (*Tinca tinca*).

11.3.46 During the 2014 surveys, European eel and spined loach were only observed on the Swavesey Drain, whilst bullhead was restricted to the Alconbury Brook. Both European eel and spined loach have a wider distribution than suggested by the 2014 study data with the former previously having been recorded in Environment Agency monitoring on the Alconbury Brook.

11.3.47 Spined loach is notable due to their specific habitat requirements, leading to populations often becoming genetically isolated from other populations. Isolation of populations is likely to have resulted from habitat degradation, pollution events or localised barriers to movement.

11.3.48 European eel have previously been recorded from all WFD watercourse crossed by the scheme with the exception of the Cottenham Lode and West Brook (the latter having not been assessed). A wider distribution of European eel may have been expected from the scheme area during the 2014 surveys, with suitable habitat, previous records and limited obvious constraints indicating the potential for this species.

- 11.3.49 European eel are migratory in nature (including short overland migrations) and would be expected to utilise all watercourses connected to the river Great Ouse catchment. Incidental records from GCN surveys indicate the presence of European eel in offline ponds within the study area.

Great crested newt

Desk study results

- 11.3.50 Forty desk study, historic scheme and incidental records for GCN were returned from the desk study dated between 1970 and 2012. No records are located directly within the scheme footprint. A concentration of records is located in Conington and small clusters of records are located in the Hinchingbrooke area in Huntingdon and at Debden Farm just outside of Godmanchester.

Field survey results (2013 & 2014)

- 11.3.51 Field surveys in 2013-14 recorded GCN in 30 water bodies (in sections 2, 3, 4 & 6). GCN were recorded in an additional two water bodies in 2009 (ponds 23 and 49). Access to these ponds was refused in 2013/14 and therefore continued presence has been assumed. *Figure 11.4* illustrates waterbody locations and survey results.
- 11.3.52 The peak count from the 2013-2014 surveys for GCN recorded in each waterbody is summarised in *Table 11.12*. A population size class assessment is provided (English Nature, 2001). Populations of 'small' to 'medium' size class have been recorded with the survey area.
- 11.3.53 *Table 11.12* summarises the key areas recorded for GCN during the surveys and lists the clusters of ponds in which GCN are likely to exist within the same meta-population (illustrated in *Figure 11.4*). *Table 11.12* includes a value for meta-population peak counts. This is the maximum count across all ponds in the meta-population from a single survey visit. This value aims to give some idea of the number of GCN in the meta-population. As not all ponds in the meta-population will have been surveyed on the same date for each survey visit, this figure should be read with caution given the potential for double counting (i.e. GCN can move between ponds). The data do however suggest that there are no 'large' metapopulations in the study area.

Table 11.12: Peak count of GCN during survey a single survey

Pond number	Peak Count	Population size class
14a	2	Small
14b	11	Medium
14c	5	Small
14d	10	Small
14e	12	Medium
14f	8	Small
21	3	Small
22	47	Medium
31	9	Small
31b	1	Small
32	4	Small
34	2	Small
52	14	Medium
52a	16	Medium
52b	26	Medium
N1	8	Small
N1b	30	Medium
N28	5	Small
N32	4	Small
N39a	13	Medium
N39b	4	Small
N39c	20	Medium
N40	1	Small
N41	17	Medium
N41a	4	Small
N42	4	Small
N43	0 (larvae only)	Small
N43a	3	Small
54	1	Small
N38	61	Medium

Population size classes: Small=1-10 peak count, medium=11-100, large> 100.

Great crested newt mitigation guidelines (English Nature, 2001).

Table: 11.13: Approximate location of GCN metapopulations

Location	Pond numbers in metapopulation*	Metapopulation peak count
West of Brampton Hut	49 (4)**	4
Hinchingbrooke	52 (14), 52b (26), 52a (16), N1b (30), N1 (8)	82
Outskirts of Godmanchester	32 (4), N28 (5), 34 (2), 31b (1), 31 (9), N32 (4)	15
Fenstanton	21 (3), 22 (47), 23 (1)**	50
Conington	N39a (13), N39b (4), N39c (20), N40 (1), N41 (17), N41a (4), N42 (4), N43 (0 – larvae only), N43a (3)	49
City of Cambridge crematorium	14a (2), 14b (11), 14c (5), 14d (10), 14e (12), 14f (8)	36

*Peak count for individual pond shown in brackets

** Surveyed in 2009

Common Toad

11.3.54 Cambridge County Council had stated during scoping that a large population of common toad were present at Chivers Lake at the eastern end of the scheme adjacent to an online section of the scheme. Forty-five incidental records of common toad were made during reptile surveys in 2013 & 2014 with generally small numbers of toads recorded across the length of the scheme (see incidental records in *table A2.3 of Appendix 11.5*). A maximum count of six common toad was made across the whole seven survey visits for reptiles at any one reptile survey location, with the exception of reptile survey location R15 the National Institute of Agricultural Botany (*Figure 11.5*) where in total 20 common toad were recorded throughout the duration of the reptile survey. This location is c. 1.5km west of Chivers Lake.

Reptiles

Desk study results

11.3.55 Data from CPERC identified four records of viviparous lizard (*Lacerta vivipara*) and eight records of grass snake in the study area.

11.3.56 A database of incidental records was maintained during the field season however no incidental records of reptiles were collected.

Field survey results (2013 & 2014)

11.3.57 Data from the surveys revealed that in the study area, there were two reptile species present, the viviparous lizard and the grass snake (*Natrix natrix*). A peak count of five viviparous lizards was recorded in October 2013 and a peak count of five grass snakes during survey visits in 2014. *Table 11.14* shows the records collected during the surveys.

Table 11.14: Reptile field survey records

Date	Site name	Species	Number
23 September 2013	R6 – Buckden Marina	grass snake	1
23 September 2013	R15 – NIAB	viviparous lizard	1
26 September 2013	R6 – Buckden Marina	grass snake	1
27 September 2013	R15 – NIAB	viviparous lizard	1
30 September 2013	R15 – NIAB	viviparous lizard	2
03 October 2013	R15 – NIAB	viviparous lizard	5
04 October 2013	R15 – NIAB	viviparous lizard	1
23 April 2014	Nursery Farm - North	grass snake	1
23 April 2014	Nursery Farm - Middle	grass snake	1
29 April 2014	Nursery Farm - Middle	grass snake	1
7 May 2014	Nursery Farm - Middle	grass snake	2
12 May 2014	Nursery Farm – North	grass snake	1
13 May 2014	Nursery Farm - Middle	grass snake	1
13 May 2014	Nursery Farm – South	grass snake	2
27 May 2014	Nursery Farm – North	grass snake	1
28 May 2014	Nursery Farm - south	grass snake	2
28 May 2014	Nursery Farm - Middle	grass snake	2
4 June 2014	Nursery Farm - North	grass snake	1
4 June 2014	Nursery Farm - Middle	grass snake	3

Birds

Breeding bird field survey results 2013 & 2014

11.3.58 The breeding bird survey results are illustrated in *Figure 11.6*. Buckden Gravel Pits CWS supported the highest numbers and species richness of breeding birds of all the areas surveyed. The breeding bird surveys recorded 70 species in total, including 11 Red-listed species and 21 Amber-listed species of conservation concern, *Birds of Conservation Concern 3: the population status of birds in the United Kingdom, Channel Islands and the Isle of Man* (Eaton et al., 2009). As breeding species, the grasshopper warbler (*Locustella naevia*) and lapwing (*Vanellus vanellus*) stand out as species that are specifically associated with the wetland habitat. The oystercatcher (*Haematopus ostralegus*) and Cetti's warbler (*Cettia cetti*) are also highlighted at this site because they represent greater than 1% of the county population. Tufted duck (*Aythya fuligula*) and gadwall (*Anas strepera*) are Amber-listed species, but both occur in low numbers relative to the estimated county population, *Cambridgeshire Bird Atlas 2007 – 2011* (Bacon, L. et al., 2013). The Red-listed species cuckoo (*Cuculus canorus*), hobby (*Falco subbuteo*) and yellow wagtail (*Motacilla flava*) were also present here during the survey.

11.3.59 The arable farmland habitats covering the majority of the scheme corridor are generally typical for Cambridgeshire being widespread and abundant across the county and neighbouring counties. Most of this habitat supported unremarkable bird assemblages and population densities are generally considered to be relatively low for most species that are common and widespread across the UK. There is a lack of quality hedgerows and boundary features in this landscape to support a rich diversity of farmland birds. However, some areas supported small numbers of farmland bird species notable for their conservation status as Red-listed birds of conservation concern. These are skylark (*Alauda arvensis*), yellowhammer (*Emberiza citrinella*), corn bunting (*Miliaria calandra*) and yellow wagtail (*Motacilla flava*). In addition the Amber-listed reed bunting was frequently found associated with ditches and watercourses and also in fields of oil seed rape.

Wintering bird field survey results 2012-2013 & 2013-2014

11.3.60 The wintering bird survey results are illustrated in *Figure 11.7*. Buckden Gravel Pits CWS also stands out as the best area for wintering birds within the study area. The site consists of a series of gravel pits created in the 1980s. Most of these are deep, steep sided waterbodies supporting large assemblages of wildfowl particularly diving ducks such as pochard (*Aythya ferina*) and tufted duck. Great crested grebe (*Podiceps cristatus*) was frequent in these lakes and a great northern diver (*Gavia immer*) was found in Lake 1 during the November 2014 survey visit. These lakes are predominantly deep open water with a narrow fringe of marginal vegetation and alder trees. The smaller, shallower pools towards the northern end of the site have more substantial marginal reed-swamp vegetation and floating plant communities and this is reflected in bird assemblages of higher species richness, including the dabbling ducks (e.g. gadwall, teal (*Anas crecca*) and wigeon (*Anas penelope*)), and roosting lapwing. A bittern (*Botaurus stellaris*) was flushed from waterbody 5 during two winter survey visits in December 2012 and February 2013. A Cetti's warbler was recorded calling during a survey visit in November 2014 in dense scrub near waterbody 5.

11.3.61 The river Great Ouse passes along the eastern boundary of Buckden Gravel Pits CWS and is bordered by fields of semi-improved grassland. The river itself supported few wintering birds apart from kingfisher (*Alcedo atthis*) and on the adjoining floodplain meadows feeding flocks of lapwing and golden plover (*Pluvialis apricaria*) and greylag geese (*Anser anser*) were occasionally found.

11.3.62 The majority of the scheme passes through intensive arable landscapes with few boundary features such as hedgerows, drainage ditches and watercourses. Wintering bird surveys covering these areas generally revealed few wintering birds. However, on some occasions, large flocks of golden plover, lapwing or gulls were recorded. The sporadic occurrence of the flocks suggests that they range over a wide area across the landscape rather than being dependant on any particular field within the scheme corridor.

*Barn owl**Desk study results*

- 11.3.63 CPERC supplied 130 records of barn owl (*Tyto alba*) observed in the study area from 1961, of which 38 were from Fen Drayton Gravel CWS. Desk study records included those supplied by the barn owl recovery programme operated by the Barn Owl Conservation Network (BOCN). Fifty-nine potential nest sites were recorded and breeding was confirmed in 30 of the locations during 2010-2013. Overall, the desk study estimated that the area within 5km of the scheme supported 55 breeding pairs.

Field survey results (2013 & 2014)

- 11.3.64 Seven incidental records of barn owls were made by surveyors during fieldwork for other species in 2014. All observations were to the west or south-west of Huntingdon (by virtue of the areas surveyed in 2014), of which three were within approximately 550m of each other to the east of the river Great Ouse (section 2) and therefore may have been of the same individual. Anecdotal evidence of roosting and foraging barn owls was also provided by local residents.
- 11.3.65 Suitable foraging habitat was identified within the survey area. This habitat mainly comprised the margins of field and/or ditches with areas of unmanaged pasture and rough grassland.
- 11.3.66 An estimated 390ha of optimal barn owl foraging habitat (Type 1) was identified within accessible areas of the study area (*Figure 11.7*). This was generally limited to the margins of arable fields and ditch banks, with larger areas located adjacent to the river Great Ouse north of Offord Cluny, directly south of the A14 at Fenstanton and south of Conington.
- 11.3.67 An estimated 255ha of sub-optimal (Type 2) habitat was identified within accessible areas of the study area (*Figure 11.7*). This was also confined to field margins, ditch banks, road verges and fields of unmanaged/rank improved and semi-improved grassland, including large areas of partially restored landfill at Buckden.
- 11.3.68 Eleven confirmed nest sites, comprising six nest boxes (three barn boxes, two tree boxes and one pole box), four tree cavities and one hay bale were identified within the study area. One nest site which was confirmed as active in 2013 (reference number 4, *Figure 11.8*), is situated within the construction footprint of the scheme (section 1).
- 11.3.69 A total of 73 potential nest sites were identified within accessible areas of the study area, of which 14 were also categorised as active roost sites (*Figure 11.8*). Two potential nest sites (reference numbers 41 and 67) are situated within the construction footprint of the scheme, and a further three potential nest sites (reference numbers 15, 21, and 64) are situated within 50m.
- 11.3.70 A total of 29 active roost sites comprising 11 nest boxes (seven in barns and four on trees), six barns, eight trees, two derelict buildings and two hay bales were also identified.

Bats

Desk study results

- 11.3.71 CPERC returned 167 records of bats in the data search undertaken by the Highways Agency in 2013 for the main scheme. No additional bat records were returned by CPERC in 2014 for the A1 widening section of the scheme.
- 11.3.72 Surveys by Atkins in 2008 (Highways Agency, 2009) identified two bat tree roosts and one possible roost. Dusk emergence surveys on 28th May 2008 identified a single common pipistrelle emerging from a crack willow tree adjacent to the river Great Ouse. Dusk surveys on 17th September 2008 identified two common pipistrelle bats emerging from the canopy of the most southerly of two mature oak trees within a hedge line east of Madingley Road (see *Figure 11.10* for roost locations). Surveys of the woodland belt north of Huntingdon police station concluded likely roosts in trees in this area.
- 11.3.73 Many of the records were for 'bat species' and bats had not been identified to species level, however records for the following species were provided:
- common pipistrelle (*Pipistrellus pipistrellus*);
 - soprano pipistrelle (*Pipistrellus pygmaeus*);
 - serotine (*Eptesicus serotinus*);
 - brown long-eared bat (*Plecotus auritus*);
 - long-eared bat species (*Plecotus* sp.);
 - barbastelle (*Barbastella barbastellus*);
 - noctule (*Nyctalus noctula*);
 - Leisler's bat (*Nyctalus leisleri*);
 - Natterer's bat (*Myotis nattereri*);
 - Daubenton's bat (*Myotis daubentonii*);
 - whiskered bat (*Myotis mystacinus*);
 - Brandt's bat (*Myotis brandtii*); and
 - *Myotis* species.
- 11.3.74 Cambridgeshire bat group returned 481 records for the main scheme and 64 records for the A1 widening (there may be partial overlap between these areas). Additional to the list above, these records included records of Nathusius' pipistrelle (*Pipistrellus nathusii*).
- 11.3.75 CPERC and Cambridgeshire Bat Group Records were plotted in GIS to determine how close they are to the scheme. There are records of 34 roosts within 1km of the site (*Figure 11.10*). None of the roosts are located within the footprint of the works.

*Field survey results (2013 & 2014)**Bat roosts*

11.3.76 A total of 12 tree roosts and eight building roosts were identified from field surveys undertaken in 2013 and 2014 (*Figure 11.10*). No evidence of roosts was recorded in any of the culverts or bridges surveyed. Woodland backtracking surveys identified two confirmed roosts, two likely roosts and three possible roosts.

11.3.77 The value of these roosts has been assigned based on the species of bat present and the type of roost in accordance with *Valuing Bats in Ecological Impact Assessment* (Wray, S. et al., 2010). (*Table 11.15*). Where there is uncertainty about the species present, it has been assumed the least common of the possible species was present (i.e. for *Myotis* species it is assumed bats were whiskered/Brandt's which are scarce).

Table 11.15: Summary of confirmed roosts in 2013 & 2014

Reference	Bat species	Species status	Evidence	Roost type	Value
Tree BT3.1b	Brown long-eared / <i>Myotis</i> species	Scarce	Droppings observed during climbing survey. No bats observed during 2 D/D surveys.	Summer roost for small numbers of a scarce species. Not a maternity roost.	District
Tree BT12.3	Pipistrelle species	Rare	1 no. bat observed during climbing surveys. No bats observed during dawn survey.	Summer roost for small numbers of a rare species. Not a maternity roost.	District
Tree J2.1	Brown long-eared/ <i>Myotis</i> species	Scarce	Droppings observed during climbing surveys. No bats observed during 2 D/D surveys.	Summer roost for small numbers of a scarce species. Not a maternity roost.	District
Tree J5.3	Common pipistrelle	Common	One bat seen emerging from tree roost during first of two surveys.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Tree K2.5	Pipistrelle species	Rare	Droppings observed during climbing surveys. No D/D surveys undertaken.	Summer roost for small numbers of a rare species. Not a maternity roost.	District

Reference	Bat species	Species status	Evidence	Roost type	Value
Tree BP1.5	Natterer's	Uncommon	1 no. bat observed during climbing surveys. One D/D survey undertaken.	Summer roost for small numbers of an uncommon species. Not a maternity roost.	District
Tree 21	Common pipistrelle	Common	2 no. bats seen entering tree roost during 2nd of 3 D/D surveys.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Tree BT2.3	Brown long-eared bat	Common	4 no. bats seen entering tree roost during 1st and 2nd of 3 surveys. At least two holes being used.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Tree BT2.4	Brown long-eared bat	Common	2 no. bats seen entering tree roost, with a possible further 3 entering roost during 1st of 3 D/D surveys.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Tree BT6.3c	Soprano pipistrelle	Common	1 no. bat seen entering tree roost on 1st of 3 D/D surveys.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Tree J2.19	Soprano pipistrelle	Common	1 no. bat seen emerging from tree roost during 1st of 3 D/D surveys.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Tree T9.1	Pipistrelle sp.	Rare	1 no. bat probably seen emerging from tree roost 2nd of 4 D/D surveys.	Summer roost for small numbers of a rare species. Not a maternity roost.	District

Reference	Bat species	Species status	Evidence	Roost type	Value
B.26 Crematorium	Common pipistrelle and brown long-eared bats	Common	BLE feeding perch within porch and arch of chapel. Individual common pipistrelle bats and 4 BLE roosting on wall during surveys. BLE maternity roost previously recorded (desk study).	Summer roost for small numbers of a common species (common pipistrelle) and maternity roost for a common species (BLE).	County
B.27 Cemetery Barn	Common and soprano pipistrelle	Common	1 bat of each species recorded emerged from roost, and returning to roost during 2 of X surveys.	Summer roost for small numbers of a two common species. Not a maternity roost.	Local
B.31 The Cottage, Offord Road	Common pipistrelle	Common	1 bat recorded returning to roost during 2 of 4 surveys.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
B.41A House on golf course	Unknown	Likely common	Droppings recorded on one survey.	Likely summer roost for small numbers of a (likely) common species. Not a maternity roost.	Local
B.41B Barn at Menzies Cambridge Golf Course	Brown long-eared	Common	Suspected emergence of a single bat on 13/08/14.	Summer roost for small numbers of a common species. Not a maternity roost.	Local

Reference	Bat species	Species status	Evidence	Roost type	Value
B.41C Barn at Menzies Cambridge Golf Course	Common pipistrelle and soprano pipistrelle	Common	Non-echolocating bats emerged on 17/7/14. Bat droppings behind cladding. 2 x soprano pipistrelle emerged 13/08/14 and a single common pipistrelle re-entered at dawn on 14/08/14 and 19/08/14.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
B.43E	Common pipistrelle	Common	Possible emergence on 21/08/14	-	-
B.45H Barn at Grange Farm	Common pipistrelle	Common	Suspected emergence of a single bat on 12/08/14. Emergence of 2 or 3 bats on 20/08/14.	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Woodland 2 (likely roost)	Common pipistrelle	Common	Likely that bat roosted within woodland	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Woodland 3	Soprano pipistrelle	Common	Single bats suspected to roost in tree	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Woodland 3 (likely roost)	Pipistrelle sp.	Common	Likely that a bat returned to roost	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Woodland 7 (possible roost)	Common pipistrelle	Common	Potential emergence of 4 bats	Summer roost for small numbers of a common species. Not a maternity roost.	Local

Reference	Bat species	Species status	Evidence	Roost type	Value
Woodland 7	Soprano pipistrelle	Common	Roost in dead tree	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Woodland 9 (possible roost)	Common pipistrelle	Common	Possible emerge form a large oak tree	Summer roost for small numbers of a common species. Not a maternity roost.	Local
Woodland 9 (possible roost)	Soprano pipistrelle	Common	Potential roosts	Summer roost for small numbers of a common species. Not a maternity roost.	Local

Potential bat roosts

- 11.3.78 The level of survey effort undertaken for buildings and culverts gives high confidence that all bat roosts within these structures have been identified. Possible exceptions are occasional night roosts or day roosts used at low frequencies however these are of lower value to bats and are unlikely to alter the results of the valuation of the site for bats.
- 11.3.79 Tree roosts are highly transitional (a strategy thought to be used by bats to reduce the likelihood of parasitism and predation) and therefore the chance of detection of a tree roost is reduced in comparison to other structures.
- 11.3.80 In addition, it is possible the scheme would result in the loss of multiple trees with bat roost potential in any one particular area and therefore there is potential for a greater impact on the local population. It is therefore important to assume a proportion of potential tree roosts may be used by roosting bats at one time or another.
- 11.3.81 A total of 38 category² 1* trees and 137 category 1 trees have been identified within 100m of the scheme with a further nine category 1 trees associated with the perimeters of borrow pits. (*Figure 11.10*). These have potential to be used by the following tree roosting species which are known to be present within the site from transect and static surveys: common pipistrelle, soprano pipistrelle, Nathusius pipistrelle, Brandt's bat, whiskered bat, Natterer's bat, noctule, serotine, brown long-eared and barbastelle.

² Category 1* trees are defined as trees with multiple, highly suitable features capable of supporting larger roosts and category 1 trees are defined as trees with definite bat potential, supporting fewer suitable features than category 1* trees or with potential for use by single bats.

- 11.3.82 Neither barbastelle nor Nathusius pipistrelle (both primarily woodland roosting bats) were recorded within the woodlands surveyed by backtracking surveys which may indicate that bats of these species, recorded commuting within/foraging within the site during other surveys, have commuted from woodlands outside of the study area where they roost.
- 11.3.83 Data from static detectors was reviewed for evidence of potential barbastelle and Nathusius pipistrelle roost locations i.e. recordings of bats within 1.5 hours of sunset or sunrise (i.e. calls close to emergence or re-entry of roosts) were identified as these may indicate proximity to a roost. Data recorded near Woodland 3 suggests the potential for a nearby Nathusius roost and data recorded near woodlands 4a and 4b suggests the proximity of a barbastelle roost.

Flight height

- 11.3.84 Data collected during field surveys suggests the majority of common pipistrelles, soprano pipistrelles and pipistrelle species flying adjacent to (as opposed to across) the A14 were flying at a minimum height of 4m.
- 11.3.85 Of all the bats observed (both flight across and adjacent to the road), 72 out of 99 were flying at a minimum height of 4m or more, with only 17 flying at 2m or less.

Foraging and commuting habitat

- 11.3.86 Common and soprano pipistrelles were by far the most frequently recorded species within the site. Ignoring the pipistrelle and *Myotis* species groups, which would include calls from a range of species, noctules were the next most frequently recorded bat.
- 11.3.87 Nathusius pipistrelles were recorded in relatively high numbers considering their rarity and were recorded at every static location surveyed across the site. Static detector (SD) locations SD10 and SD11 were particular hotspots for this species. For SD10 this was due to a very high count of Nathusius pipistrelle in September whereas for SD11 Nathusius levels were more consistent amongst each month surveyed.
- 11.3.88 Barbastelle activity was higher than the activity levels of some less rare species such as serotine, brown long-eared and Leisler's. A particularly high level of barbastelle activity was recorded at SD5 (discussed below). Barbastelles were recorded during four of the five months surveyed at this location, with particularly high number of calls (25 within five nights) in May. Other locations with high numbers of calls for this species include SD9, SD33, SD35, SD41 and SD42.
- 11.3.89 The relatively low levels of the individual *Myotis* species (whiskered/Brandt's/Alcathoe/Daubenton's/Natterer's) is likely to be due to the fact most *Myotis* calls could not be identified to species level, and hence have been grouped as *Myotis* species.

- 11.3.90 The level of brown long-eared activity is likely to have been underestimated due to the fact this species has a particularly quiet echolocation call with a low detectability.
- 11.3.91 The areas of highest value for bats were SD5, SD6, SD8, SD10, SD11, SD12, SD22, SD28, and SD41 (*Figure 11.9*). These areas generally had relatively high levels of bat activity, a high species richness of bat (i.e. 12 or more species were recorded) and/or recorded the presence of particularly notable species such as barbastelle and/or Nathusius' pipistrelle. A summary of results at these locations is provided below in *Table 11.16*.
- 11.3.92 The same species or groups of bats were recorded during transects as the static monitoring surveys. The relative abundance of each species recorded during transect surveys was broadly similar to the static surveys, although fewer barbastelles were recorded compared to other bats. Transects 3, 5, 13 and 19 are of high value for bats (*Figure 11.9*). A summary of those transects demonstrating the highest bat value is provided below in *Table 11.17*.

Table 11.16: Summary results for static detectors of highest value for bats

Static detector ref.	Location description	Comment
SD5	Located on a hedgerow linking Brampton Wood with the scheme.	High levels of common and soprano pipistrelle and the highest level of barbastelle activity recorded throughout the site.
SD8	Located along a tree line a watercourse/ditch which also has connectivity to Brampton Wood.	Valued highly for its species richness and moderate barbastelle activity.
SD10, SD11 and SD12	Located close to the river Great Ouse and Buckden Gravel Pits.	Each recorded high levels of bat activity and a high species richness. In addition they all had moderate levels of barbastelle activity and high/moderate levels of Nathusius activity.
SD22	Approximately 0.25km from Fenstanton Gravel Pits within a predominantly arable landscape	High levels of bat activity, moderate levels of Nathusius activity and a high species richness.
SD28	In-line with wet drainage channel/ditch. North of A14, adjacent to sewage works with double hedgerow present.	High levels of bat activity and a high species richness although barbastelle and Nathusius levels were low.

Static detector ref.	Location description	Comment
SD6	Adjacent to Lenton Lakes. East of the A1	High species richness and moderate bat activity and barbastelle levels. High levels of activity due to high levels of soprano pipistrelle activity likely to be due to the proximity of the detector to some fishing lakes (soprano pipistrelles have an association with water).
SD41	East of A1	High species richness and supported moderate bat activity, moderate Nathusius levels and high barbastelle levels. High levels of activity due to high levels of soprano pipistrelle activity likely to be due to the proximity of the detector to some fishing lakes (soprano pipistrelles have an association with water).

Table 11.17: Summary results for transects of highest value for bats

Transect ref.	Habitat description	Comment
3	Buckden gravel pits and the river Great Ouse with adjacent semi-improved grassland. All water courses and water bodies within are bordered by mature tree-lines, hedgerows and areas of wet woodland.	High levels of bat activity, high species richness and the presence of high numbers Nathusius pipistrelle. This correlates with the high value identified from the results of the static monitoring for SD10, 11 and 12 which are in the same vicinity. The high value is due to the presence of high quality bat foraging habitat, the river Great Ouse and Buckden Gravel Pits, in this part of the site.
5	Arable habitat bordered by broadleaved plantation of mature and semi-mature woodland to the east and hedgerows to the west.	Moderate levels of activity for a high diversity of bat species, including barbastelles. The habitats around transect 5 are not of particular note for bats although some strips of semi-mature woodland are present.
13	Arable habitat surrounded by localised areas of broadleaved plantation. Some hedgerows including a double hedgerow.	Medium levels of bat activity, including Nathusius pipistrelle, the presence of barbastelle bats, and a high species richness. High activity levels were due to high activity from common, soprano and Nathusius pipistrelles. Nathusius pipistrelle is primarily a woodland bat, <i>British Bats</i> . (Altringham, J., 2003) and so its presence in a primarily arable habitat can only be attributed to the small blocks of broadleaved plantation in the vicinity.

Transect ref.	Habitat description	Comment
19	A large lake with two densely vegetated islands. Semi-improved grassland, tall ruderals, and semi-mature trees border the transect with some small areas of broadleaved woodland to the east.	High levels of bat activity, including moderate <i>Nathusius pipistrelle</i> activity, and high species richness. As per transect 3 this is likely to be due to the presence of high quality bat foraging habitat because of its proximity to a large lake. Woodland 1 which is also in this vicinity contributes to the interest in this area. This feature would appear to be valuable for bats as it provides a strong commuting line under the A14 to potential foraging habitat to the north, although SD44 and SD45 located to the west on the Impington Guided Busway were valued low for bats.

11.3.93 The majority of the other transects had similar, moderate, values for bats (including the transect in Huntingdon town centre). Exceptions were transect 15, 16 and 18, either side of the A1 to the north of Brampton Interchange, transect 6 which is located on an offline section of the scheme, and transect 10 located northwest of the existing A14 which were all assigned a low value. This is generally as a result of low levels of bat activity and an absence of rare species (although a *barbastelle* was recorded on transect 10).

11.3.94 Of the bridges and culverts surveyed, the following were identified as being used by commuting bats:

- Impington Guided Busway Bridge (Feature 6) - common and soprano pipistrelles recorded commuting under the bridge under the A14.
- Girton A14 Bridge West (Feature 14) - common and soprano pipistrelles recorded commuting under the footbridge under the M11.
- Huntingdon Life Science Northern Culvert (Feature 28) - common pipistrelles commuting over the A1.
- Northern culvert (Feature 29) - common pipistrelles commuting over the A1.
- Ellington Brook (Feature 31) - soprano pipistrelles commuting over the A1, *Nyctalus* species and brown long-eared bats commuting through the culvert.
- A1 Overbridge (Feature 37) - common and soprano pipistrelles commuting under bridge. Soprano pipistrelles commuting over A1.

11.3.95 Activity levels at the three structures monitored remotely (Girton A14 Bridge West, Beck Brook Culvert and the A1 Overbridge) varied significantly.

- 11.3.96 Detectors at the A1 Overbridge (Feature 37) recorded the highest activity and had the greatest richness of species (up to 10 species). The land around SD5A is valued as high for bats, based on species richness and activity levels, whereas the land around SD6A is valued as moderate due to its slightly lower species richness and activity levels. The majority of activity was from common pipistrelle and included foraging, commuting and social calls.
- 11.3.97 Feature 14 (SD1A and SD2A) had low activity levels and species richness and so the land around detectors SD1A and SD2A is considered low value for bats. In June, most activity was recorded by the detector located to the east of the M11 bridge (SD1A), with very little activity to the west of the M11 bridge. The results indicate that bats were not utilising the bridge for commuting or foraging, which corroborates the results of the emergence, return and activity surveys. The activity was most likely associated with the field edges to the east of the M11.
- 11.3.98 A low level of bat activity was recorded at SD3A whereas moderate activity and a higher species richness were recorded at SD4A (Feature 15, Beck Brook).

Summary of bat records from field surveys and desk study

- 11.3.99 Surveys throughout the scheme and information gathered during the desk study have confirmed the presence of the species listed in *Table 11.18*. It has been assumed that any long-eared bats recorded on site are brown long-eared as opposed to the rarer grey long-eared due to the restricted range of this species in the south of England.

Table 11.18: Bats recorded during surveys and their status (BCT, 2013)

Species	Abundance	Population estimate	Distribution
Common pipistrelle	Common	243,000	Widespread across UK
Soprano pipistrelle	Common	1,300,000	Widely distributed across most of UK
Nathusius pipistrelle	Rare	16,000	Widespread through British Isles
Serotine	Uncommon	15,000	Mainly restricted to southern England and Wales
Brown long-eared	Common	245,000	Widespread across UK
Barbastelle	Rare	5,000	Restricted to southern and central England, and Wales
Noctule	Scarce	50,000	Widespread through England and Wales
Natterer's	Uncommon	148,000	Widespread through British Isles
Daubenton's	Common	560,000	Widespread across UK
Whiskered	Scarce	64,000	Throughout England and Wales, into Scotland and Northern Ireland
Brandt's	Scarce	30,000	Throughout England and Wales

Brown hare

11.3.100 Brown hare is present with the survey area and is known to be widespread and common within the region. Nine incidental records were made of this species during survey work undertaken in 2014 (January-August). Arable, grassland and woodland habitats, which are common and widespread within the survey area, are all suitable to support this species.

Water vole and otter (riparian mammals)

Desk study results

11.3.101 Historic and field survey data obtained for water vole (*Arvicola amphibius*) and otter (*Lutra lutra*) are illustrated in *Figure 11.11*. CPERC returned a total of 58 records for water voles and 23 records for otters. Records for otters are concentrated around the river Cam, river Great Ouse, Ellington Brook and Alconbury Brook and their catchments areas. There are particular concentrations of records for water voles collected northeast of Cambridge, near the town of Milton.

11.3.102 Data collected by the Cambridgeshire and Peterborough Biodiversity Partnership revealed that a total of 19 otters were killed through anthropogenic influences during the period 2004-13, 15 of those incidents were road traffic accidents.

Field survey results

11.3.103 Incidental records obtained by ecologists whilst conducting field surveys for other taxa throughout the scheme in 2014 identified two sites as positive for otter. Both sites contained otter spraints found under bridges that straddle Ellington Brook, north of the A14 and Alconbury Brook, close to Huntingdon Racecourse (*Figure 11.11*).

11.3.104 A single potential water vole latrine was identified west of Girton in 2013 (*Figure 11.11*). As the droppings were not fresh and were in poor condition, identification of water vole here is considered precautionary. Two sites were positively identified for the presence of otter via identification of spraints. One site was located near to Fenstanton on a waterway linked to West Brook with the second site at Fen Drayton (*Figure 11.11*).

11.3.105 In 2014, two sites in section 1 were positively identified for the presence of water vole via the identification of latrines, burrows, footprints, pathways and feeding remains (*Figure 11.11*). At both sites identified there was a combination of field signs at regular intervals (every 2-5m) along the entire stretch of the waterways surveyed. Field signs were recorded within Alconbury Brook especially in the vicinity of OS grid reference TL 193 732 (*Figure 11.9*) and near to the south-bound layby of the A1 widening section of the A14 development scheme.

11.3.106 Seven sites were positively identified for the presence of otters via identification of spraints or footprints or a combination of both (*Figure 11.11*). All positive sites included the major tributaries within the area of the scheme including Alconbury Brook, Cock Brook and Ellington Brook. Otter signs were frequent along Alconbury Brook and Ellington Brook extending from OS grid reference TL 196 721 in the east, to TL 186 719 in the west. Field signs for otters were recorded within Cock Brook from OS grid reference TL 190 744 in the south, adjacent to Huntingdon Life Sciences research centre, to TL 186 747 in the north. All field signs were found under bridges, on berms, fallen trees or tree root systems. No otter holts or couches were recorded during surveys.

Badger

11.3.107 Desk study data provided 33 historical records of badger in the study area (provided by CPERC and the Cambridgeshire Mammal Group).

11.3.108 Since 2003 varying levels of badger activity have been recorded along the whole of the scheme with a large number of observations, including the presence of main setts with substantial excavations, associated annex and subsidiary setts, and outlier setts scattered throughout the surrounding countryside (*Figure 11.12*).

11.3.109 Principal concentrations of activity were found in the countryside near to Fenstanton, the Girton interchange and Orchard Park areas, as well as smaller foci at Brampton and Lolworth.

11.3.110 The proximity of main setts reflects the distribution of different clans or social groupings. The closest main setts were found to be approximately 1km apart, whilst the furthest were 10km apart.

11.3.111 Known main setts and significant associated setts (Annex and Subsidiary) are listed in *Table 11.19* below. Twelve main setts were recorded and mapped in the 2013/14 surveys.

11.3.112 Substantial badger sett excavations were identified at main setts 1.2 (Brampton), 5.5 (south of Hemingford Golf Club), 6.6 (near Fenstanton) and R5 (Bar Hill).

11.3.113 The baseline surveys and the bait marking studies undertaken in 2010 identified fifteen social groups (A-0) along the scheme. The location and distribution of these groups shown in *Figure 11.12*.

Table 11.19: Significant badger setts

Label	Sett type	Social group ¹	Distance (minimum) from works (m)	Total no. holes	No. well used	No. partially used	No. inactive
1.2	Main	A	200	>19	>8	>5	>6
5.2	Main	Unknown	90 (in BP 3)	7	>7	0	0
5.5	Main	F	90	>35	13	20	2
6.1	Main	J	60	8	3	3	2
6.6	Main	I	270	23	7	7	9
10.1	Main	Unknown	80	5	3	0	2
I1	Main	Unknown	10	9	6	0	3
11.1	Subsidiary	Unknown, likely to be the same as 11.2 and 11.3	100	1	1	0	0
11.2	Main	As above	140	3	2	0	1
11.3	Annex	As above	200	1	1	0	0
A26	Main	Unknown	near BP 1	9	7	0	2
R5	Main	Unknown	80	22	20	0	2
R6	Main	Unknown	500	12	3	7	2
BP2.10	Main	Unknown	70m north BP 2	7	0	0	7
I5	Subsidiary	Unknown	0m	3	3	0	0

¹Social group identified based on bait marking studies carried out in 2008/2009. Where setts were not included in the 2008/09 survey, social groups cannot be identified. BP = borrow pit

Evolution of baseline and climate change

11.3.114 The land use occupied by the scheme footprint is dominated by arable farmland. In the absence of the scheme, i.e. the do-nothing scenario, this is considered unlikely to change. The only factors which are likely to change the predominant landscape are considered to relate to changes in the long-term economics of farming (which could be driven by changes in climate), resulting in a change of land-use.

11.3.115 As outlined in *Biodiversity and Climate Change - a summary of impacts in the UK (IACCF 2010)*, Climate change is likely to result in a range of changes to the distribution and abundance of ecological features at a national scale (some beneficial and some adverse). Adaptation to these changes requires the protection of ecologically diverse sites and an increase in semi natural habitats and connectivity between them to facilitate successful adjustments of the range of species. This chapter assesses whether the scheme protects designated sites and the net change in area of semi natural habitats and connectivity.

Evaluation of ecological features

11.3.116 The evaluation of ecological features is presented in detail in the relevant technical reports (*Appendices 11.1-11.10*) and summarised below in *Table 11.20*. This evaluation takes into account the baseline conditions and utilises the criteria in outlined in *Table 11.3* to develop an understanding of the implications for features that may be affected by the scheme. The results of the evaluation have been used to design specific and appropriate mitigation.

Table 11.20: Evaluation of ecological features

Receptor	Value						
	Site	Local	District	County	Regional	National	International
Portholme SAC/SSSI							Y
Ouse Washes SAC/SPA/Ramsar/SSSI							Y
Eversden & Wimpole Woods SAC/SSSI							Y
SSSIs						Y	
County Wildlife Sites				Y			
City Wildlife Sites			Y				
Protected Roadside Verges PRV		Y					
Broadleaved woodland semi-natural		Y					
Broadleaved woodland plantation		Y					

Receptor	Value						
	Site	Local	District	County	Regional	National	International
Coniferous woodland plantation	Y						
Mixed woodland plantation	Y						
Trees		Y					
Scrub	Y						
Hedge – species poor, intact		Y					
Hedge – defunct	Y						
Hedge with trees		Y					
Running water		Y					
Standing water		Y					
Dry ditch	Y						
Wet ditch		Y					
Swamp, marginal & inundation		Y					
Arable	Y						
Poor semi-improved grassland	Y						
Semi-improved grassland, neutral	Y						Y ¹
Amenity grassland	Y						
Improved grassland	Y						
Tall ruderal	Y						
Bare ground	Y						
Hardstanding	Y						
Aquatic invertebrates		Y					
Terrestrial invertebrates	Y	Y ²		Y ³			
Fish			Y				
Great crested newt		Y					
Common toad	Y						
Reptiles	Y						
Birds ⁴	Y	Y	Y	Y			
Barn owl				Y			
Bats		Y ⁵	Y ⁶	Y ⁵			

Receptor	Value						
	Site	Local	District	County	Regional	National	International
Brown hare	Y						
Water vole		Y					
Otter		Y					
Badger	Y						

¹ Semi-improved, neutral grassland within the Portholme SAC.

² Trees listed in section 11.3.25

³ Buckden Gravel Pits

⁴ *Table 5.1* in the Birds Baseline Report (*Appendix 11.6*) provides a summary of the conservation status and an evaluation of the study area for all the Red and Amber-listed species. Cetti's warbler is included in this assessment due to its legal status. No species likely to be affected by the scheme fall into the international or nationally valuable categories. There are five species that are considered to be valuable at county level. These are bittern, cuckoo, Cetti's warbler, goldeneye and shoveler. The corn bunting, kestrel, green woodpecker oystercatcher, pochard and song thrush are considered to be valuable at the district level. This reflects either their relative scarcity elsewhere in Cambridgeshire (e.g. green woodpecker), or that they are particularly well represented in Cambridgeshire (e.g. corn bunting, yellow wagtail), but scarce elsewhere in the UK. The populations of corn bunting and yellow wagtail within the study site itself do not meet county or national level criteria. The majority of species are considered to be of local value by virtue of their Red or Amber listing.

⁵ Individual roosts have been valued from local up to county value (details of individual bat roosts are provided in *Table 11.16*)

⁶ The overall value of the study area for foraging and commuting bats has been assessed as district value.

11.4 Generic mitigation

11.4.1 The scheme design incorporates certain measures which would provide mitigation for ecological features. These have been identified and developed through the EIA iterative process. The following provides an outline of the general mitigation measures that would be employed to minimise the impact of the scheme on ecology.

11.4.2 *Figure 11.13* illustrates both the proposed landscaping scheme, plus additional areas proposed for ecological mitigation that have been designed into the scheme, for use to meet specific habitat and species requirements.

11.4.3 Specific mitigation for valued ecological features is discussed in detail later in this chapter, in the impact assessment for each individual receptor. Further information regarding ecological mitigation can also be found in *Appendix 20.1*.

- Avoidance of impact is the first principle of mitigation.
 - Seek to minimise disturbance to environmentally sensitive areas through the careful siting of haulage routes, material storage areas, compounds, lighting, generators and other construction requirements.
 - Use appropriate exclusion zones around protected habitat areas such as trees, woodlands, hedgerows and watercourses, and designated sites to avoid accidental damage.
 - Adhere to the Environment Agency's Pollution Prevention Guidelines (PPG) in particular PPG01, PPG06, PPG13, PPG18, PPG22 and PPG23 and ensure the necessary consents for working in proximity to watercourses are obtained.
 - Adopt Construction Industry Research and Information Association (CIRIA) guidance in particular CIRIA C650 - Environmental Good Practice on Site (2nd Edition), 2005, CIRIA C532 - Control of Water Pollution from Construction Sites, 2001 and CIRIA C648 - Control of water pollution from linear construction projects, 2006.
 - Avoid disturbance to breeding birds by avoiding vegetation clearance/structure demolition during the bird breeding season (typically February to August inclusive).
 - Where appropriate undertake tree surgery such as pollarding and coppicing in preference to tree felling so as to retain habitat resource.
 - Retain ample site-won materials, such as timber, brash and rubble, for habitat creation purposes such as hibernacula, egg laying sites, temporary shelter, and providing connectivity.
 - Design required lighting in accordance with best practice guidance e.g. *Bats and lighting in the UK*, *Bats and the Built Environment Series* (Bat Conservation Trust, 2009); *Artificial lighting and wildlife, Interim guidance: Recommendations to help minimise the impact artificial lighting* (Bat Conservation Trust, 2014), *A review of the impact of artificial lighting on invertebrates* (Bruce-White & Shardlow, 2011) in order to help minimise effects on wildlife and other features.
- Ensure no net loss of valued semi-natural habitats.

- Maintain key north-south wildlife dispersal corridors across scheme, using culverts and structural planting (in conjunction with appropriate fencing and sensitive lighting).
- Aim to maximise east-west habitat connectivity along the scheme with new landscaping using native, locally appropriate species.
- Aim to maximise new habitat linkage to existing habitat features and designated sites (e.g. Brampton Wood SSSI, Buckden Gravel Pits CWS/River Great Ouse CWS, Fenstanton Pits CWS)
- Seek to minimise culverting of watercourses.
 - Design necessary culverts in accordance with published best practice to help minimise their impact on the watercourse and increase their suitability to provide a wildlife underpass. e.g. *CIRIA C689D (Culvert Design and Operation Guide)*.
- Creation of new habitats (including those of Principal Importance for the Conservation of Biodiversity, the HABAP and local BAPs) along the highways estate and in the restored borrow pit areas, with appropriate management programmes, in order to achieve net habitat gain along the scheme.
 - Design balancing ponds and drainage swales to have a secondary biodiversity function.
 - Incorporate river restoration techniques to increase benefits for habitats and species when realigning watercourses.
 - Increase habitat for key species that are limited by low habitat area / connectivity across the scheme e.g. dormice, barn owl, great crested newt.
 - A mitigation area suitable specifically for common toad, a Section 41 Species, has been provided adjacent to Chivers Lake to provide additional habitats for this species and also to act as a receptor site for this species, should this be required. This is in response to scoping comments provided by Cambridge County Council for common toad in this specific location.
 - Use locally native tree, shrub and herbaceous species in the landscape mitigation. Avoid the use of invasive and competitive grass species.

11.4.4 *Appendix 20.2* sets out a series of measures and standards of work that would be applied by the Highways Agency and its main contractors throughout the construction period. Of particular relevance to ecological features are measures to reduce dust and air pollutant emissions and to prevent changes in the water environment. At a local level, site specific control measures would be included within Local Environmental Management Plans, which would be developed following consultation with the relevant stakeholders. The Highways Agency would require its main contractors to have an Environmental Management System certified to BS EN ISO14001, which would be documented within a Construction Environment Management Plan (CEMP). The CEMP would include roles and responsibilities, together with appropriate control measures, training and briefing procedures, risk assessments and monitoring systems to be employed during planning and constructing the works for all relevant topic areas.

11.4.5 Within the text below in *Section 11.5*, mitigation is classified as temporary or permanent. Permanent mitigation (habitat gain) is that which would be safeguarded/maintained long-term, through Highways Agency ownership and would form part of the new highway estate. This would include drainage ponds and swales as well as all dedicated ecological mitigation areas as shown on Figure 11.13. Temporary mitigation (habitat gain) includes areas where permanence of the restoration habitat would not be secured beyond five years post opening, i.e. borrow pits, soil storage areas, construction compound and floodplain compensation areas, as these would not form part of the new highway estate. Whilst much of what is classified as temporary mitigation would in all likelihood remain as that habitat to which it is restored, as this cannot be guaranteed, the distinction between permanent and temporary mitigation is used here to ensure the worst case scenario is considered within the assessment. Where areas classified as temporary mitigation do remain long term, these are likely to provide biodiversity enhancements.

11.5 Impacts, mitigation and significance of effects

11.5.1 This section of the ES chapter identifies the likely residual effects of the scheme based on our current knowledge of the ecology present within the zone of influence of the scheme. It takes account of all mitigation measures to be included in the scheme and specific mitigation measures identified below for individual features.

Potential impacts

11.5.2 There are a number of ways in which a highways scheme can impact on biodiversity and nature conservation, both during construction and once the road has opened. These impacts may be temporary or permanent. The main pathways to impacts are listed below and these are considered in relation to specific ecological features below:

- Habitat loss (and gain) -is directly attributable to the change of land use. The offline sections of the scheme, including borrow pits and contractor's compounds, are where these effects are likely to be most significant as the land take is at its greatest.
- Changes in environmental conditions - Habitats and species both within and beyond the scheme boundary, could be impacted upon by changes in environmental conditions such as changes in water quality and air quality.
- Disturbance - Disturbance resulting from construction and traffic can lead to significant effects on sensitive species.
- Severance/fragmentation - Given the predominantly arable landscape, the severance of existing wildlife corridors along the scheme (such as watercourses, field margins, hedgerows and tree lines) could have significant effects on species in the area.
- Species mortality during construction - Less mobile species, or animals that are young or hibernating, are likely to be those most vulnerable to direct mortality during construction.
- Species mortality (vehicle collisions) - Many animals are killed on UK roads each year and this is likely to be the case on the new roads in the scheme in the absence of mitigation.
- Disturbance from road lighting - Impacts from lighting are most likely to affect bat species (and other mammals) along the alignment of the scheme. Habitats where the impact of lighting can be particularly severe include habitats along river corridors, woodland edges and hedgerows.

Ecological features

11.5.3 The following applies to all ecological features brought forward to the detailed ecological impact assessment stage that are considered valued ecological features:

- their value is assessed as being important at a local level or higher; and
- they are potentially vulnerable to significant effects from the scheme.

11.5.4 Ecological features brought forward for assessment are:

- Portholme SAC/SSSI;
- Ouse Washes SAC/SPA/Ramsar/SSSI;
- Eversden and Wimpole Woods SAC/SSSI;
- SSSIs;
- CWSs, CiWSs, RSVs;
- Phase 1 Habitats:
 - broadleaved woodland, semi-natural;
 - broadleaved woodland, plantation;
 - trees;
 - hedge, species-poor intact;
 - running water;
 - standing water;
 - wet ditch; and
 - swamp and marginal inundation.
- aquatic invertebrates;
- terrestrial invertebrates;
- fish;
- great crested newt;
- breeding birds;
- barn owl;
- wintering birds;
- bats;
- otter; and
- water vole.

Impact assessment

Designated sites

11.5.5 For those designated sites with no direct hydrological links to the scheme and which are >50m from areas of construction (i.e. beyond the range in which dust is likely to pose a significant issue), no impacts are anticipated. This includes:

- Madingley Wood SSSI;
- Little Paxton Pits SSSI (3km upstream of scheme);
- St Neots Common SSSI (6.9km upstream of scheme);
- Settling Bed CWS;
- Lattenbury Hill Parkland CWS;
- Mere Lane CWS;
- Wooley Lays RSV CWS;
- River Cam CWS;
- Littlebury Farm Meadow CWS;
- Low Meadow CWS;
- Hermitage Wood CWS;
- Ellington Pastures and Underlands CWS;
- Park Road Grasslands CWS;
- Marsh Lane Gravel Pits CWS;
- Fen Drayton Gravel Pits CWS;
- Fenstanton Meadows CWS;
- all CiWS; and
- all PRVs.

11.5.6 Given that the majority of designated sites listed in *Tables 11.5 and 11.6* would not suffer any direct land take/habitat loss as a result of the scheme and that these sites are primarily designated for habitat features (as opposed to mobile species that may be impacted by disturbance, fragmentation and mortality), the main potential for impacts would be changes to environmental conditions via air (dust during construction and nitrogen oxide and nitrogen deposition during operation) and water quality.

11.5.7 In the majority of cases, the potential for any such impacts has been designed out via the design mitigation through the use of avoidance measures and the implementation of best practices measures ensuring no significant effects. In relation to air quality impacts during operation, a detailed air quality and emissions assessment has been undertaken as part of the EIA for the scheme in accordance with *DMRB Volume 11 Section 3 Part 1* (Highways Agency, 2007). The assessment included a quantitative assessment of effects of changes in air quality on statutory designated sites from nitrogen oxides and nitrogen deposition. Full results are included in *Chapter 8* and demonstrate a decrease in annual NO_x concentration and nitrogen deposition at all designated sites included within the assessment (all statutory sites within 200m of the scheme which are within the affected road network). Thus no adverse effects are predicted on these sites as a result of air quality during operation and indeed the scheme may actually be beneficial in this respect.

11.5.8 Designated sites for which potential adverse effects, via changes in environmental conditions as discussed above, have been screened out as neutral as a result of design mitigation are as follows:

- Brampton Wood SSSI;
- Brampton Racecourse SSSI;
- Fenstanton Pits CWS;
- Brampton Flood Meadows CWS;
- Madingley Brick Pits CWS;
- Brampton Road A1 Slip Road CWS;
- West Meadow CWS; and
- Hinchingsbrooke Gravel Pits CWS

11.5.9 Those designated sites not listed above and considered worthy of more detailed assessment relating to potential impacts are discussed below.

Portholme SAC/SSSI

11.5.10 Further detailed information on the impact assessment for Portholme SAC is provided in *Appendix 11.12*.

11.5.11 There would be no direct habitat loss within Portholme SAC as a result of the scheme. At its closest point (Huntingdon section) the scheme would be 35m north of the SAC and 11m from the SSSI where the proposed DCO boundary is close to an outfall to the Alconbury Brook. The SAC would be separated from the scheme by the Alconbury Brook and a small area of residential housing.

11.5.12 Potential impact on the Portholme SAC/SSSI could occur via changes in environment conditions (water and air quality).

- 11.5.13 Water quality: During construction of the scheme there could be a potential risk via changes in environmental conditions if local water quality is affected by pollution from suspended solids and other pollution sources, including metals and hydrocarbons. This could enter Portholme SAC during inundation events and could have a negative effect on vegetation and the conservation objectives of the site.
- 11.5.14 Construction related impacts on water quality would be mitigated for during the construction phase via measures included in *Appendix 20.2* as summarised in Section 11.4 and a detailed account of proposed mitigation is provided in *Chapter 17*. These measures would result in a neutral effect during construction as a result of water quality.
- 11.5.15 The habitat within the SAC is alluvial flood meadow and is surrounded by watercourses (the river Great Ouse and Alconbury Brook), therefore the control of water levels and water quality within the SAC are important to the long-term functioning of the habitat. Once operational, drainage could carry polluted road runoff into local watercourses and this could enter Portholme SAC through flood waters, particularly from the Huntingdon area.
- 11.5.16 All permanent operational discharge from the scheme would be discharged to surface waters. However, the total paved area of highway around Huntingdon would be reduced, consequently reducing pollutant loading and discharge volume to the water environment. The drainage design for the scheme would also involve the incorporation of new, higher standards of surface water management than those which are currently used by the existing A14. The works in Huntingdon town centre would incorporate attenuation prior to discharge. The proposed attenuation storage is via a combination of storage ponds and below ground “milk–crate” storage due to constraints on space in the vicinity of Huntingdon Station car park.
- 11.5.17 The de-trunking of the A14 in Huntingdon and the associated traffic reduction on the roads in Huntingdon within 1km of Portholme SAC should contribute to reduced pollution and reduced risk of spillage incidents.
- 11.5.18 Water levels are predicted to rise upstream of the river Great Ouse crossing at times of flood, for the likely worst case scenario; however, there is anticipated to be no impact to water levels downstream of the crossing (*Chapter 17*). The Portholme SAC is located >3kms downstream of the crossing and as a result it is anticipated that there would be no physical modifications to the watercourses surrounding the SAC. Two outfalls are proposed upstream of the site, but the impacts on the biological, physico-chemical and hydromorphological elements of the WFD water bodies have been assessed as being localised and are unlikely to have an impact on a water body scale. None of the watercourses near to the SAC site are failing with respects to the Highways Agency Water Risk Assessment Tool (HAWRAT) assessment for water quality (*Chapter 17*).
- 11.5.19 There would be no direct effects from groundwater on the Portholme SAC. It is located well away from the influence of groundwater dewatering and proposed flood compensation areas and no long term effects on groundwater levels or flows in this area are anticipated (*Chapter 17*).

- 11.5.20 Effects as a result of changes in water quality are therefore considered to be neutral during operation.
- 11.5.21 Air quality (operation): A detailed air quality and emissions assessment (*Chapter 8* for full details) has demonstrated a decrease in annual NO_x concentration and nitrogen deposition at Portholme SAC/SSSI. It is not possible to say that this decrease would have a significant positive effect on the site and thus effects are considered neutral.
- 11.5.22 No significant adverse effects have been identified for the Portholme SAC/SSSI during the construction or operational phase of the scheme and effects are therefore considered to be neutral.

Ouse Washes SAC/SPA/Ramsar/SSSI

- 11.5.23 Further detailed information on the impact assessment for the Ouse Washes SAC/SPA/Ramsar/SSSI is provided in *Appendix 11.12*.
- 11.5.24 The Ouse Washes SAC/SPA/Ramsar/SSSI site is 9.3km from the nearest point of the scheme.
- 11.5.25 A number of (highly mobile) wildfowl species, particularly gadwall (*Anas strepera*), that are also qualifying species of the Ouse Washes SPA/Ramsar, occur in the scheme corridor. It is unlikely that bird species, which are qualifying features for the Ouse Washes SPA/Ramsar and which are present in the study area during winter and the breeding season, would be adversely affected by the scheme. Wintering birds can range several kilometres from the site boundaries, but it is considered that past 5km the size of the area potentially available to them is so large that it is highly unlikely that habitat further afield would be critical to the integrity of the site and the population of the species. The *AIES (Appendix 11.12)* confirms that impacts on the Ouse Washes SPA were screened out due to the distance.
- 11.5.26 Given the direct hydrological connectivity of the scheme with the Ouse Washes SAC/Ramsar/SSSI, potential impacts could occur via changes in environment conditions (water quality).
- 11.5.27 Water quality: During construction of the scheme there could be a potential risk via changes in environmental conditions if local water quality is affected by pollution from suspended solids and other pollution sources, including metals and hydrocarbons.
- 11.5.28 Whilst the scheme is directly hydrologically linked with the SAC/Ramsar, >20km of the river Great Ouse separate the SAC/Ramsar from any direct works related to the river. Construction related impacts on water quality would be mitigated for during the construction phase via measures included in *Appendix 20.2* as summarised in *Section 11.4* and a detailed account of proposed mitigation is provided in *Chapter 17*. These measures would result in a neutral effect during construction as a result of water quality.

11.5.29 During operation, the assessment of water quality (*Chapter 17*) found that the scheme would be beneficial to water quality in the river Great Ouse catchment as it would provide attenuation and treatment of road runoff where none currently exists. Effects on the Ouse Washes SAC/Ramsar/SSSI as a result of water quality during operation are considered to be neutral.

Eversden and Wimpole Woods SAC/SSSI

11.5.30 Further information on the impact assessment for Eversden and Wimpole Wood SAC is provided in the *AIES (Appendix 11.12)*.

11.5.31 Eversden and Wimpole Woods SAC is 9.6km from the nearest point of the scheme. No direct habitat loss would occur and no potential impacts as a result of changes in environmental conditions, relating to water and air quality are considered likely at this distance from the scheme. No pathways to impacts are therefore considered likely during construction.

11.5.32 Barbastelle bats are a mobile species and individuals can range many kilometres. Adverse effects could therefore occur during operation if flightlines and/or key foraging areas were to be lost or fragmented and therefore potential impacts on the Eversden and Wimpole Woods SAC/SSSI could occur as a result of severance.

11.5.33 SCDC's *Local Development Framework Biodiversity Supplementary Planning Document* (SCDC, 2009) identifies a barbastelle bat area of importance for Eversden and Wimpole Woods SAC, which incorporates the area known to include key flightlines and foraging areas critical to the SAC population (*Figure 11.15*). The scheme is over 3.28km from the area of importance for the SAC determined by SCDC.

11.5.34 Surveys undertaken as part of the scheme in 2013 and 2014 recorded 232 separate barbastelle bat passes (*Figure 11.15* for locations of records). Of the 232 records, 104 were within 20km of the SAC and the remaining 128 were more than 20km from the SAC. The closest record to the offline sections of the scheme is 15.4km away and the closest record to the online sections of the scheme is 10.4km away.

11.5.35 The scheme is 3.28km from the area of importance for the SAC determined by SCDC. There are no obvious flightlines from the area of importance for the SAC and the scheme. Wetland areas within the immediate valley of the river Great Ouse and Portholme SAC meadows could provide foraging for barbastelle bats, but there is no obvious landscape connectivity between the area of importance for the SAC and these potential foraging areas. Any barbastelle bats using these foraging areas are therefore either unlikely to be from the SAC population or are males from the SAC ranging over long distances.

11.5.36 Survey data from 2014 suggests that there is a barbastelle bat roost in Brampton Wood, explaining the increased records of the species at that north-western end of the scheme. Any population using a roost in Brampton Wood is highly unlikely to be associated with the SAC population due to the lack of connectivity of habitat between the two populations.

- 11.5.37 Given the distance of the SAC from the scheme and the apparent lack of habitat connectivity between the two areas, effects on the SAC as a result of the scheme are assessed as neutral.

Brampton Meadow SSSI

- 11.5.38 The SSSI is within the proposed DCO boundary; however no direct land-take would occur as a result of the scheme. The majority of the works in the vicinity of Brampton Meadow would be undertaken either within the existing highways boundary or south of the A14 with the exception of the construction of a new slip road to the north. There are no soil storage, construction compounds or borrow pits proposed within 100m of the Brampton Meadows and these would all be located south of the existing A14. Impacts on the SSSI could occur as a result of:

- changes in environmental conditions (water and air quality); and
- severance.

- 11.5.39 Changes in environmental conditions (construction): Standard construction best practice measures, as outlined in the design mitigation and in *Appendix 20.2*, would mitigate for any potential impacts arising from changes in environmental conditions, via the creation of dust or surface water run-off during construction, and effects are considered to be neutral during the construction phase.

- 11.5.40 Changes in environmental conditions (operation): The air quality assessment of effects of changes in air quality on ecologically designated sites from nitrogen oxides and nitrogen deposition has demonstrated a decrease in annual NO_x concentration and nitrogen deposition at Brampton Meadows SSSI (*Chapter 8* for further details). It is not possible to say that this decrease would have a significant positive effect on the site and thus effects are considered neutral.

- 11.5.41 Severance: The creation of a new access road between the A1 and A14 north of the scheme would leave the Brampton Meadows SSSI surrounded on all sides by roads. However, the ecological mitigation plan (*Figure 11.13*) shows that the land to the west of Brampton Meadows SSSI would be utilised as an ecological mitigation area with the planting of semi-improved grassland designed to complement the adjacent SSSI enhancing the resilience and value of the existing SSSI habitat. This would be an improvement on the ecological diversity of surrounding habitats from the current arable land use and mammal crossings (culverts), proposed for alignment with the unnamed brook that runs along the northern boundary of the SSSI, would retain the connection of this area to the wider countryside for mobile species. Effects on the Brampton Meadow SSSI as a result of severance are considered to be neutral/slight beneficial.

- 11.5.42 Overall, effects for Brampton Meadow SSSI are considered to be neutral for the construction phase and neutral/slight beneficial for the operational phase.

River Great Ouse CWS

- 11.5.43 The scheme would pass directly over the river Great Ouse CWS via a viaduct that would carry the new A14 dual carriageway over the river (River Great Ouse Viaduct: see *Chapter 3* for further information on the design of this structure). No habitat would be lost from the CWS as a result of land-take, there would be no in-channel works and no in-channel piers or bed structure would be required. Potential impacts are possible via changes in environmental conditions (water quality, dust and shading).
- 11.5.44 Water quality: During construction, impacts are possible via changes in the water environment. These impacts have been assessed in detail in *Chapter 17*. During construction, the implementation of best practice; clear guidance in the *Code of Construction Practice (Appendix 20.2)* and the use of method statements should lead to no significant effects on water quality. Minimal disturbance is predicted to shallow groundwater flows as a result of any viaduct embankment and pile foundations, with no significant effects expected on the hydrogeological functioning of the river Great Ouse (*Chapter 17* for further details). Effects on the river Great Ouse during construction as a result of water quality are considered to be neutral.
- 11.5.45 During operation, the assessment of water quality (*Chapter 17*) found that the scheme would be beneficial to water quality in the river Great Ouse catchment as it would provide attenuation and treatment of road runoff where none currently exists. Effects on the river Great Ouse as a result of water quality during operation are considered to be neutral.
- 11.5.46 Dust: Standard construction best practice measures, as outlined in the design mitigation and in *Appendix 20.2*, would mitigate for any potential impacts arising from changes in environmental conditions, via the creation of dust and effects are considered to be neutral during the construction phase.
- 11.5.47 Shading: Localised impacts are likely as a result of direct shading beneath the new viaduct during operation. This is likely to result in a localised reduction in productivity of both the in-stream and marginal habitats. This effect would be restricted to the c.30m width of the viaduct and thus is unlikely to cause any significant connectivity issues. Habitats on the margins of the bridge are likely to persist albeit they may be replaced by more shade tolerant species. These localised impacts are considered unlikely to have a significant effect on the functioning/integrity of the river Great Ouse ecosystem. Effects on the river Great Ouse as a result of shading during operation are considered to be neutral.
- 11.5.48 Effects on the designated features of the River Great Ouse CWS during construction and operation are considered to be neutral.

Buckden Gravel Pits CWS

- 11.5.49 The scheme would pass directly through and over the Buckden Gravel Pits CWS. The River Great Ouse Viaduct would carry the new A14 dual carriageway over the CWS therefore limiting land-take. Potential impacts on the cited features at Buckden Gravel Pits CWS include:
- habitat loss; and
 - changes in environmental conditions (dust, water quality, shading).
- 11.5.50 Habitat loss: In order to allow for pier construction, access routes and maintenance of the proposed viaduct, part of the water bodies present would be in-filled directly below the deck of the new viaduct. During construction the following habitat loss would take place:
- standing water 0.3ha;
 - swamp/marginal and inundation 0.3ha; and
 - semi-improved grassland 0.3ha.
- 11.5.51 The loss of standing water would result in the loss of and changes to the distribution of aquatic and marginal wetland species. However the aquatic communities affected are likely to be supported elsewhere within the remaining open water habitat, of which the area to be lost equates <0.7% and no significant effects on the vulnerability of aquatic populations would arise. The area of grassland to be lost equates <1.4% of existing semi-improved grassland recorded within the CWS. The area of swamp/marginal and inundation habitat to be lost equates to <15% of the area of swamp/marginal and inundation habitat recorded within the CWS during the Phase 1 habitat survey³.
- 11.5.52 Whilst small areas of habitat would be permanently lost, the scheme includes the provision of reshaped and re-planted edges as part of the restoration to the remaining waterbodies within this part of the Buckden Gravel Pits CWS which would provide marginal habitats as mitigation for the loss of open water and aquatic habitats. These small losses in habitat are not considered likely to have a significant effect on the overall functioning/integrity of the CWS and effects on the designated features of the Buckden Gravel Pits CWS as a result of habitat loss are considered to be neutral.

³ The entire CWS was not included in the Phase 1 habitat survey and thus this figure of 15% is likely to be an over estimate of the percentage of the total area of this habitat to be lost given further areas of this habitat are likely to be present in the wider CWS. The same applies to other figures relating to percentage grassland loss at Buckden Gravel Pits CWS.

- 11.5.53 Water quality: During construction potential impacts are possible via changes in the water environment. These impacts have been assessed in detail in *Chapter 17*. During construction the implementation of best practice; clear guidance in *Appendix 20.2* and the use of method statements should lead to no significant effects on water quality. Minimal disturbance is predicted to shallow groundwater flows as a result of the viaduct embankment and pile foundations with no significant effects expected on the hydrogeological functioning of the Buckden Gravel Pits (*Chapter 17* for further details).
- 11.5.54 During operation, the assessment of water quality (*Chapter 17*) found that the scheme would be beneficial to water quality in the river Great Ouse catchment as it would provide attenuation and treatment of road runoff where none currently exists. Water quality effects on the Buckden Gravel Pits CWS are therefore considered to be neutral during operation.
- 11.5.55 Dust (during construction): Impacts from dust during construction are only considered likely to be an issue over an area of c.50m from construction works. Standard construction best practice measures, as outlined in the design mitigation and in *Appendix 20.2*, in addition to specific mitigation outlined in *Chapter 8* would mitigate for any potential impacts arising from changes in environmental conditions, via the creation of dust and effects are considered to be neutral during the construction phase.
- 11.5.56 Shading (operation): As described above for the river Great Ouse, localised impacts are likely as a result of direct shading beneath the new viaduct. However, as these impacts are very localised beneath the bridge, effects as a result of shading during operation are considered to be neutral.
- 11.5.57 Effects on the designated features of Buckden Gravel Pits CWS during construction and operation are considered to be neutral. Further details on potential impacts on specific taxa related to the Buckden Gravel Pits i.e. bats and birds, are discussed below in species specific impact assessments.

Habitats

- 11.5.58 Potential impacts on habitats include:
- habitat loss; and
 - changes in environmental conditions.
- 11.5.59 These impacts are considered to be particularly important to address for locally valued habitats which include broadleaved woodland, trees, hedge, running and standing water, wet ditch and swamp, marginal and inundation habitat, which provide relatively diverse habitat for wildlife within a predominately arable landscape.

- 11.5.60 Habitat loss: *Table 11.21* illustrates the habitat losses and gains that would occur as a result of the scheme. Gains are identified as permanent or temporary, as previously outlined (in *Section 11.4*), where permanent gains are those that would fall within Highways Agency soft estate or would be returned in the pre-scheme state to the landowner, and so can be guaranteed long term whilst temporary gains cannot be guaranteed as these would fall outside the soft estate beyond the five year restoration period. On areas that would be returned to the same management as before the scheme i.e. compounds, soil storage areas, flood compensation areas and some borrow pits, the habitats lost have been calculated and the same habitats then included in the permanent gain figures. Construction: There would be total habitat loss of 1,030ha during construction (excluding hardstanding), of which 87% would be arable habitat. Arable land is considered to be of relatively low ecological value and is abundant widespread in the local area, thus the loss of this habitat type would not be considered significant. In addition there would be a loss of 20.1km of linear habitat including species poor hedges and wet and dry ditches.
- 11.5.61 Of the habitats identified as requiring further assessment in this chapter due to their local value, the following losses would occur during construction:
- broadleaved woodland semi-natural 5.3ha;
 - broadleaved woodland plantation 18ha;
 - trees <1ha;
 - hedge (intact including with trees) 7.8km;
 - running water <1ha;
 - standing water 3.9ha;
 - wet ditches 3.6km; and
 - swamp and marginal and inundation 0.3ha.
- 11.5.62 Whilst the scheme would be constructed in a phased manner and certain habitats would be created prior to construction, temporary, slight adverse effects are anticipated for the above semi-natural habitats during the construction phase.
- 11.5.63 Operation: As a result of the design mitigation there would be a net permanent gain in semi-natural habitats, excluding the loss of arable habitat, of 271ha of which 24% would be woodland and 74% would be semi-improved grassland (both of which are HABAP habitats). Including temporary habitat gain this figure could rise to 461ha dependant on the long term land use of those areas that would not form part of the permanent highways soft estate. These temporary gains include notable areas of running and standing water.

- 11.5.64 There would be a loss of broadleaved woodland as a result of the scheme of between 10 and 17ha (dependant on what temporary gains are retained long term and with 17ha being the worst case scenario). However, this loss of broadleaved woodland would be offset by a net permanent gain in woodland overall of 66ha composed of mixed woodland which is a HABAP habitat. This permanent net gain in woodland cover in the area of the scheme should offset the loss of broadleaved woodland and improve the long term viability of woodland in the area of the scheme.
- 11.5.65 Scattered (parkland) trees should see a net permanent gain of 17ha which offsets the loss of 1ha of this habitat. This would complement the gains seen in the cover of woodland habitats.
- 11.5.66 A total loss of intact hedge of 7.8km would occur as a result of the scheme during construction. This is all considered to be species poor hedge. This would be replaced by a permanent gain of over 30km of species rich intact hedgerow, including hedges with trees, thus increasing the connectivity of the landscape and the species richness of the hedgerow habitat available.
- 11.5.67 Less than 1ha of running water habitat would be lost as a result of the scheme during construction with a permanent gain of 0.5ha achieved. The worst case scenario for this habitat is a permanent net loss of 0.2ha. It is not considered that a net loss of 0.2ha of running water would be significant in terms of the functionality of this habitat in the local area.
- 11.5.68 A large total net gain of 72ha would be seen in standing water habitats as a result of the scheme. The majority of this is from borrow pit areas which would be flooded post-construction and as such this gain must be considered temporary, albeit many of these areas are likely to be retained as standing water long term. As a worst case scenario -1.5ha of standing water habitat would be permanently lost as a result of the scheme but this loss is considered unlikely to be significant in terms of the cover and functionality of this habitat in the local area and effects are considered neutral.
- 11.5.69 A loss of 3.6km of wet ditch would be incurred during construction. However a permanent net gain of 4.5km is proposed to offset this loss and provide an enhancement for this habitat.
- 11.5.70 A loss of 0.3ha of swamp, marginal and inundation habitat would be lost during construction. A total net gain of 11ha could be achieved however the majority of this can only be classed as temporary gain as it would be associated with the flooded borrow pits. As a worst case scenario 0.1ha would be permanently gained as a result of the scheme.
- 11.5.71 During operation there would be a net gain in semi-natural habitats, including Highways Agency Priority Habitats as a result of the scheme and a permanent, slight positive effect is likely during the operational phase.
- 11.5.72 Changes in environmental conditions: The construction phase is likely to result in dust being generated across the site which could potentially result in habitat degradation within 50m of works due to retained vegetation being

smothered. Accidental pollution during construction would be of particular concern if it happened in proximity to sensitive habitats such as water bodies, potentially resulting in habitat degradation. However these impacts would be mitigated for via the design mitigation and as such, residual effects on habitats during construction due to changes in environmental conditions are considered to be neutral.

- 11.5.73 The operational phase is likely to result in polluted run-off and accidental pollution which would be of particular concern if it happened in proximity to sensitive habitats such as water bodies, potentially resulting in habitat degradation. However, this would be avoided or reduced to levels which are not significant by the design mitigation and as such, residual effects on habitats during operation due to changes in environmental conditions are considered to be neutral.

Table 11.21: Habitat losses and gains

Habitat	Habitat loss	Permanent gain	Temporary gain	Net gain (temporary + permanent)	Net permanent gain
Broadleaved woodland-semi-natural	5.3ha	1.2ha	<0.1ha	-4.1ha	-4.1ha
Broadleaved woodland-plantation	17.6ha	4.3ha	7.8ha	-5.5ha	-13.3ha
Coniferous woodland-plantation	0.8ha	0.8ha	0ha	<0.1ha	<-0.1ha
Mixed woodland-plantation	1.4ha	84.5ha	11.5ha	94.6ha	83.1ha
Parkland and scattered trees	0.7ha	18.1ha	11.2ha	28.6ha	17.4ha
Line of trees	887.7m	0m	0m	-887.7m	-887.7m
Scrub	4.1ha	12.0ha	1.4ha	9.2ha	7.8ha
Hedges, species-poor intact	4,710.9m	0m	0m	-4,710.9m	-4,710.9m
Hedges, species-rich intact	0m	27,940.4m	3,922.9m	31,863.3m	27,940.4m
Hedges with trees	3,120.7m	9,660.8m	2,734.1m	9,274.2m	6,540.1m
Defunct hedge	1,414.9m	0m	0m	-1,414.9m	-1,414.9m
Running water-rivers, streams/brooks	0.7ha	0.5ha	0ha	-0.2ha	-0.2ha
Standing water-lakes & ponds	3.9ha	2.4ha	71.9ha	68ha	-1.5ha
Dry ditches	6,364.3m	0m	0m	-6,364.3m	-6,364.3m
Wet ditches	3,609.5m	8,119.7m	0m	4,510.2m	4,510m
Swamp, marginal and inundation	0.3ha	0.4ha	10.7ha	10.8ha	0.11ha
Arable	894ha	136.5ha	227.2ha	-530.4ha	-757.6ha
Poor semi-improved grassland	50.8ha	246.4ha	57.8ha	253.5ha	195.6ha
Semi-improved grassland-neutral	26.1ha	30.5ha	4.7ha	9.2ha	4.4ha
Amenity grassland	5.6ha	1.6ha	0.2ha	-3.8ha	-4.0ha
Improved grassland	14.6ha	3.5ha	7.2ha	-3.9ha	-11.1ha

Habitat	Habitat loss	Permanent gain	Temporary gain	Net gain (temporary + permanent)	Net permanent gain
Tall ruderal	3.7ha	1.0	0.1ha	2.5ha	-2.7ha
Bare ground	0.5ha	0.5ha	0ha	<-0.1ha	<-0.1ha
Hardstanding	16.3ha	113.8ha	0ha	97.5ha	97.5ha

Aquatic invertebrates

11.5.74 Each of the seven WFD watercourses crossed by the scheme has been assessed for impacts in relation to activities proposed as part of the scheme specific to those watercourses. Activities include the creation of outfalls and culverts, re-alignment and bridging. Potential impacts as a result of these activities include:

- habitat loss;
- direct mortality during construction;
- severance via loss of connectivity/habitat fragmentation; and
- changes in environmental conditions including:
 - sedimentation;
 - changes in water quality as a result of polluted run-off;
 - increased discharge;
 - changes in flow conditions; and
 - de-watering.

11.5.75 *Table 11.22* summarises the assessment of potential impacts for each activity in turn. Following the implementation of scheme mitigation, all effects are considered neutral at the construction stage and neutral/slight positive during operation. No significant adverse effects are anticipated. Any positive effects would be as a result of re-alignment activities creating additional channel habitats for aquatic invertebrates. Positive effects are considered probable at this stage rather than certain as the precise details of re-alignment would be developed at the detailed design phase.

Table 11.22: Assessment of potential impacts and mitigation for aquatic invertebrates

Activity and locations	Potential impacts	Construction/Operation	Mitigation	Residual effect
Outfall – Cock Brook, Alconbury Brook, Swavesey Drain, Cottenham Load	Habitat loss – loss of marginal habitats	Construction	Seek to minimise bank length required for outfall and headwalls.	Neutral
	Pollution – potential for polluted road run off to enter watercourses	Operation	Pollution Prevention Guidelines (PPGs), appropriate drainage and SuDS to prevent direct release of road run-off into watercourse.	Neutral
	Changes in hydrology - increased discharge during wet weather	Operation	Appropriate drainage and retention, balancing ponds/swales for controlled discharge into watercourse.	Neutral
Culvert – Alconbury Brook, Ellington Brook, West Brook Swavesey Drain, Cottenham Load	Direct mortality – incurred during de-watering/culvert insertion	Construction	No taxa of value likely to be impacted and the invertebrate communities are largely ubiquitous to the wider watercourse.	Neutral
	Habitat loss – minor habitat loss in culvert extension/insertion	Construction & operation	Seek to minimise culvert length. Potential to increase re-alignment length to mitigate for habitat loss.	Neutral
	Habitat fragmentation – increased culvert lengths preventing invertebrate drift	Construction & operation	Use CIRIA/Environment Agency culvert design best practice to include natural substrate in culvert beds to facilitate movement through culvert of features and ensure no net gain in velocity.	Neutral
	Changes in hydrology - increase in velocity	Operation		Neutral

Activity and locations	Potential impacts	Construction/Operation	Mitigation	Residual effect
Realignment, Alconbury Brook, West Brook, Swavesey Drain	Direct mortality – dewatering of existing watercourse	Construction	No taxa of value likely to be impacted, and the invertebrate communities are largely ubiquitous to the wider watercourse	Neutral
	Habitat fragmentation – Loss of connectivity during construction	Construction	Seek to minimise construction period to maintain connectivity of watercourse	Neutral
	Pollution (sediments) – release of sediments from earthworks	Construction	Follow appropriate Pollution Prevention Guidelines	Neutral
	Habitat loss –infilling of existing watercourse	Construction	New alignment to create habitat equal (or better) than lost to realignment. Net increase in total channel length to mitigate loss of aquatic habitat from other construction activities.	Neutral/slight positive, permanent (probable)
	Habitats gain – creation of new channel	Operation		
	Changes in hydrology – different velocity/flow conditions	Construction & operation	Realignment to maintain current average velocities / flow volume.	Neutral
Viaduct (clear span)– Great Ouse	None anticipated – no works in watercourse	n/a	Adhere to Environment Agency and CIRIA best practice guidelines.	Neutral
Clear Span Bridge – Ellington Brook	None anticipated – no works in watercourse	n/a	Adhere to Environment Agency and CIRIA best practice guidelines.	Neutral

Terrestrial invertebrates

- 11.5.76 The results of invertebrates surveys carried out in 2010 and 2013 indicate that the site, as a whole, is of relatively low value for invertebrates, *A14 Cambridge to Huntingdon Improvement Scheme; Terrestrial Invertebrate Survey Report* (Highways Agency, 2013b) and no invertebrate species that are afforded direct legal protection under any UK or European legislation were encountered during the surveys. A single Section 41 listed species, the white-spotted pinion moth, was identified during the 2013 surveys.
- 11.5.77 Based on the survey results, four very localised areas were identified as having invertebrate interest within the route of the scheme:
- a mature oak tree at TL 283 677;
 - the mature oak tree at Brampton Park /A1 junction (TL 198 699);
 - elm trees south of Wood Green Animal Shelter (TL 264 677); and
 - wetland & riparian vegetation in the vicinity of Buckden (TL 21 68).
- 11.5.78 Potential impacts to terrestrial invertebrates in these specific areas of interest include:
- habitat loss; and
 - changes in environmental conditions (dust, water quality and shading).
- 11.5.79 Habitat loss: Whilst in general the scheme design mitigation would aim to retain mature trees and vegetation within the area acquired for the scheme, the three tree locations identified specifically above would be permanently lost due to the footprint of the new road. This would result in the loss of a breeding site for the Section 41 listed species the white-spotted pinion moth which is strictly associated with English elm. Wetland and riparian habitat would also be lost at the Buckden Gravel Pits CWS albeit <1% of the total habitat area in the Buckden Gravel Pits CWS would be lost to the scheme including 0.7% of the standing water area.
- 11.5.80 The loss of mature oaks and elms trees would result in temporary, slight adverse effects on invertebrates during construction whilst effects at Buckden Gravel Pits are not considered significant due to the limited land-take.

- 11.5.81 The loss of mature oaks and elm trees would be mitigated for via the inclusion of oak and English elm in landscaping and mitigation area planting mixes to offset any slight adverse effects on species such as the white-spotted pinion moth. Given the limited area of habitat lost at the Buckden Gravel Pits and the inclusion of waterbodies and wetland planting in the design mitigation, impacts here are considered unlikely to have a significant effect on invertebrate populations. In general, the scheme planting and ecological mitigation areas would provide a diverse range of new habitats which overall should be a benefit to invertebrates when compared to the current predominantly arable landscape and a permanent, slight positive effect for invertebrates is expected as a result of the scheme during operation due to habitat creation.
- 11.5.82 Changes in environmental conditions (dust, water quality and shading): Given that the three specific tree locations of value identified above would be lost to the scheme the only area of invertebrate value considered here is Buckden Gravel Pits CWS. As detailed above for the CWS specifically, taking into account the implementation of design mitigation, effects as a result of water quality effects, dust and shading are considered neutral for the Buckden Gravel Pits. Thus no significant adverse effects are considered likely for the invertebrate interest at the site due to changes in environmental conditions either during construction or operation and effects are considered neutral.

Freshwater fish

- 11.5.83 Each of the seven WFD watercourses crossed by the scheme has been assessed for impacts in relation to activities proposed as part of the scheme specific to those watercourses. Activities include the creation of outfalls and culverts, re-alignment and bridging. Potential impacts as a result of these activities include:
- habitat loss;
 - direct mortality during construction;
 - disturbance leading to avoidance behaviour;
 - loss of connectivity/habitat fragmentation; and
 - changes in environmental conditions including:
 - Sedimentation;
 - changes in water quality as a result of polluted run-off;
 - increased discharge;
 - changes in flow conditions; and
 - de-watering.

11.5.84 *Table 11.23* summarises the assessment of potential impacts for each activity in turn. Following the implementation of scheme mitigation all effects are considered neutral at the construction stage and neutral/slight positive during operation. No significant effects are anticipated. Any positive effects would be as a result of re-alignment activities creating additional channel habitats for fish. Positive effects are considered probable at this stage rather than certain as the precise details of re-alignment would be developed at the detailed design phase.

Table 11.23: Assessment of potential impacts and mitigation for freshwater fish

Activity and locations	Potential impacts	Construction/ Operation	Mitigation	Residual effect
Outfall – Cock Brook, Alconbury Brook, Swavesey Drain, Cottenham Load	Habitat loss – loss of marginal habitats	Construction	Seek to minimise bank length required for outfall and headwalls.	Neutral
	Disturbance -light and noise causing behavioural avoidance	Construction	Seek to minimise lighting and overnight working. Use soft start piling.	Neutral
	Pollution – potential for polluted road run off to enter watercourses	Operation	Pollution Prevention Guidelines, appropriate drainage and SuDS to prevent direct release of road run-off into watercourse.	Neutral
	Changes in hydrology - increased discharge during wet weather	Operation	Appropriate drainage and retention, balancing ponds/swales for controlled discharge into watercourse.	Neutral
Culvert – Alconbury Brook, Ellington Brook, West Brook Swavesey Drain, Cottenham Load	Direct mortality – incurred during de-watering/culvert insertion	Construction	Fish removal prior to de-watering and construction.	Neutral
	Disturbance -light and noise causing behavioural avoidance	Construction	Seek to minimise lighting and overnight working. Use soft start piling. Avoid key migratory periods (eel).	Neutral
	Habitat loss – minor habitat loss in culvert extension/insertion	Construction & operation	Seek to minimise culvert length. Potential to increase re-alignment length to mitigate for habitat loss.	Neutral
	Habitat fragmentation – increased culvert lengths preventing invertebrate drift	Construction & operation	Use CIRIA/Environment Agency culvert design best practice to include natural substrate in culvert beds to facilitate movement through culvert of features and ensure no net gain in velocity.	Neutral
	Changes in hydrology - increase in velocity	Operation		Neutral

Activity and locations	Potential impacts	Construction/ Operation	Mitigation	Residual effect
Realignment, Alconbury Brook, West Brook, Swavesey Drain	Direct mortality – dewatering of existing watercourse	Construction	Undertake fish removal prior to works and move fish to unaffected watercourse reach.	Neutral
	Disturbance -light and noise causing behavioural avoidance	Construction	Seek to minimise lighting and overnight working. Use soft start piling. Avoid key migratory periods (European eel).	Neutral
	Habitat fragmentation – Loss of connectivity during construction	Construction	Seek to minimise construction period to maintain connectivity of watercourse. Avoid key migratory periods (European eel).	Neutral
	Pollution (sediments) – release of sediments from earthworks	Construction	Follow appropriate Pollution Prevention Guidelines.	Neutral
	Habitat loss – infilling of existing watercourse and creation of new alignment	Construction	New alignment to create habitat equal (or better) than lost to realignment. Net increase in total channel length to mitigate loss of aquatic habitat from other construction activities	Neutral/slight positive, permanent (probable)
	Habitat gain – creation of new alignment	Operation		
	Changes in hydrology – different velocity/flow conditions	Construction & operation	Realignment to maintain current average velocities / flow volume.	Neutral
Viaduct (clear span)– Great Ouse	Disturbance -light and noise causing behavioural avoidance	Construction & operation	Seek to minimise lighting and overnight working during construction and use soft start piling. Minimise light pollution from operation road.	Neutral
Clear Span Bridge – Ellington Brook	Disturbance -light and noise causing behavioural avoidance	Construction & operation	Seek to minimise lighting and overnight working during construction and use soft start piling. Minimise light pollution from operation road.	Neutral

Great crested newt

- 11.5.85 In relation to potential impacts on GCN, the following pathways to impacts have been identified:
- habitat loss;
 - changes in environmental conditions;
 - disturbance;
 - severance;
 - species mortality during construction;
 - species mortality via vehicle collisions; and
 - disturbance from street lighting.
- 11.5.86 Habitat loss: The principal potential impact on GCN would be the reduction in terrestrial habitat required to support their GCN populations in the vicinity of individual waterbodies. GCN is a terrestrial species during most of its annual cycle and loss of a sufficient area of suitable habitats would reduce the species' ability to forage, shelter, avoid predators and hibernate, and would adversely affect gene flow within local related groups or metapopulations. Where a waterbody is lost, the main effect is reduction in population size, through reduced breeding and recruitment opportunities.
- 11.5.87 No waterbodies known to support GCN would be lost due to the scheme, but the close proximity of such waterbodies to soil storage areas, borrow pits and the constructed new road indicates that there would be a significant loss of terrestrial habitat around some waterbodies (i.e. loss of suitable terrestrial habitat within 500m of known GCN waterbodies). It is estimated that 15ha plus 3.4km of linear habitat suitable for GCN within 500m of GCN ponds would be permanently lost as a result of the scheme.
- 11.5.88 Nine ecological mitigation areas have been identified within *Appendix 20.1* as GCN receptor sites (*Figure 11.13*). These total in area 14.3ha and a GCN receptor site is located within 500m of all confirmed GCN waterbodies. New waterbodies would be created within the identified GCN receptor sites. As part of the design mitigation, 271ha of semi-natural habitats would be created, much of which would be suitable for GCN.
- 11.5.89 Given the mitigation provided in terms of specific GCN receptor sites and the net gain in semi-natural habitats as a result of the design mitigation, habitat loss is considered to have a neutral effect on GCN.
- 11.5.90 To create potential enhancements, balancing waterbodies and swales would be designed to have a secondary biodiversity function that would result in an increased availability of potential breeding sites for GCN. Where groundwater and topographic conditions are suitable, borrow pits would be restored to provide habitat gains, including potential GCN breeding waterbodies, although any habitat gains obtained in borrow pit areas must be considered temporary as previously described. SuDS waterbodies would be designed to have a secondary wildlife function.

- 11.5.91 Changes in environmental conditions: Proximity of breeding waterbodies to soil storage areas, borrow pits and construction sites has the potential to alter the nutrient status of waterbodies and to change vegetation communities as a result of dust deposition, overland flow of soil particles and deposition of vehicle-sourced pollutants. Pollutants transported by surface water flows from construction works and operational highways have the potential to affect GCN through lethal and sub-lethal effects on the species, impacts on prey species, contamination of waterbody waters and impacts on plant species health and species composition. Close proximity of breeding waterbodies to busy highways has the potential to alter the nutrient status and vegetation communities as a result of deposition of airborne pollutants during operation.
- 11.5.92 Although GCN is found in both acid and alkaline waterbodies they tend to be found more in neutral to slightly alkaline waters. Pollution control measures during construction would prevent significant impacts on breeding waterbodies from airborne nutrients and pollutants (*Appendix 20.2*). The presence of extant breeding waterbodies within 250m of the present A14 and A1 indicate that local waters are capable of buffering the effects of airborne nutrients from operational busy highways. Potential water-borne pollution incidents would be prevented by the implementation of best practice as per the design mitigation. No significant effects on GCN are anticipated as a result of changes in environmental conditions.
- 11.5.93 Disturbance: Disturbance arising from construction traffic has the potential to disrupt GCN foraging and dispersive behaviour. Greater accessibility of waterbodies arising from the proximity of construction and storage areas has the potential to result in disturbance from casual activities by members of the workforce or the general public. Disturbance would also arise where newt populations are translocated because of their proximity to the works or because of a reduction in the habitat available for the species.
- 11.5.94 Haul routes would be designed to avoid the vicinity of GCN breeding waterbodies and fencing during construction would deter casual access to waterbodies. Waterbodies for GCN translocation would be secured as early as possible in order to reduce disturbance effects arising from translocation. No significant effects on GCN are anticipated as a result of disturbance.
- 11.5.95 Severance: Construction works and the provision of a new offline section of the A14 has the potential to create barriers to GCN movements between waterbodies. These movements are required for newt populations to function as coherent parts of the local metapopulation, and to encourage persistence of populations as waterbodies respond variably to between-year differences in weather and water levels. Separation of waterbodies that are used by a metapopulation by construction of the scheme is likely to result in severance of the population in the absence of mitigation.

- 11.5.96 A single group of waterbodies (located in section 3 of the scheme) identified as likely to support a metapopulation of GCN would be severed as a result of the scheme. The scheme would separate three waterbodies (waterbodies 34 and N32 *Figure 11.4*) to the south of the offline route in the outskirts of Godmanchester from four waterbodies to the north (waterbodies 31, 31b, 32 and N28, *Figure 11.4*). Those waterbodies to the north of the new road would be further separated temporarily during construction by the use of land between the waterbodies as a soil storage area. However, waterbodies to the south would continue to have the ability to host a metapopulation, although the small numbers of animals present in each waterbody suggests that the local gene pool would become restricted. There would also be a greater potential for local extinction resulting from intermittent drying out of waterbodies.
- 11.5.97 In this location GCN receptor areas would be provided which include new GCN terrestrial habitat and waterbodies on both side of the road. The receptor sites are located within 250m of these waterbodies on both the north and south sides of the new road and are complemented by two culverts with dry passage for GCN to maintain connectivity (*Figure 11.13*) which would eliminate the effects of severance for this metapopulation.
- 11.5.98 A further nine dedicated GCN underpasses and ten suitable general use underpasses (*Figure 11.13*) notably at Fenstanton and the three at Girton interchange, would maintain connectivity for GCN along the route of the road. No significant effects as a result of severance are therefore anticipated for GCN.
- 11.5.99 Species mortality during construction: Thirty-two known GCN waterbodies are within 500m of the route of the scheme. The majority of adult GCN usually forage and hibernate within 250m of the breeding waterbody if suitable habitats exist, so the density of individuals gradually decreases away from the waterbody. However, newts may travel further if there are areas of high quality foraging and refuge habitat extending beyond this range. There is therefore potential for foraging, dispersing and hibernating newts to be killed by site vehicle and foot traffic, construction activities and by stockpiling of soils and materials. Newts may also be trapped in excavations left open overnight.
- 11.5.100 All potential GCN waterbodies within 250m of the construction corridor would be re-surveyed prior to commencement of the works to ensure data is up-to-date and the presence or absence of GCN is determined. Surveys would be carried out at the optimum survey time, mid-March to mid-June, with at least two of these visits during mid-April to mid-May. Where there is limited foraging habitat between the waterbody and the construction corridor, the use of barrier and newt fencing would be sufficient to prevent conflicts between GCN and construction site activities. Where construction activities are likely to adversely affect the functions of GCN waterbodies and terrestrial habitats, translocation under licence from Natural England would be undertaken as a means of preventing GCN mortality (*Appendix 11.11*). With this awareness of the potential for GCN mortality and

standard mitigation measures to prevent it, species mortality arising from construction would not have a significant effect on local GCN populations.

- 11.5.101 Species mortality (vehicle collisions): GCN are susceptible to road mortality, especially where new roads cross existing migration routes. This is most obvious in March, as animals make their way to their breeding waterbodies. Mortality may also occur as animals leave their waterbodies. New kerbs have the potential to trap newts within the carriageway, leading to them becoming road casualties. Road gullies may also act as fall traps for GCN along carriageway margins.
- 11.5.102 Knowledge of the location of GCN habitats in the vicinity of the new road assists the provision of mitigation measures designed to guide animals away from the new carriageway. The risk to animals is perhaps greatest where waterbodies currently used by a metapopulation are separated by new road (as for waterbodies N28, 31, 31b, 32, 34 N32, *Figure 11.13*). Where the risk of road mortality exists, mitigation measures would be introduced that include provision of newt fencing, translocation, dry underpasses (nine dedicated GCN underpasses plus ten general use underpasses suitable for GCN use) and vegetation designed to guide animals along the road to the nearest underpass e.g. at Godmanchester, Fenstanton and Girton interchange (*Figure 11.13*). Capture of newts for translocation would take place during the species' active period, between February and October and would take place under licence from Natural England (*Appendix 11.11*).
- 11.5.103 Disturbance from street lighting: There is limited information available with regard to the effects of street lighting on GCN. The species is largely active at night, and lighting may make animals more susceptible to predation.
- 11.5.104 The limited use of new street lighting, restricted to junctions, suggests that there would be limited scope for effects on GCN. This factor is screened out as a potential impact on GCN.
- 11.5.105 With the incorporation of mitigation measures into the scheme, effects are considered to be neutral at the construction phase. Given the net increase in GCN breeding and terrestrial habitats, a slight, permanent, positive effect for GCN is anticipated during the operational phase.
- 11.5.106 A summary of the anticipated effects on GCN as a result of the scheme is provided below in *Table 11.24*.

Table 11.24: Summary of assessment of potential impacts and mitigation for GCN

Potential Impacts	Construction/operation	Mitigation	Residual effects
Habitat loss (gains)	Construction & operation	<ul style="list-style-type: none"> No waterbodies known to support GCN lost. Staged construction approach. Implementation of design mitigation measures. Nine GCN receptor sites included in scheme design. As part of the design mitigation, 271ha of semi-natural habitats would be created, much of which would be suitable for GCN. 	Neutral & slight positive (for habitat creation)
Changes in environmental conditions	Construction & operation	<ul style="list-style-type: none"> Implementation of design mitigation measures. 	Neutral
Disturbance	Construction	<ul style="list-style-type: none"> Haul routes designed to avoid the vicinity of GCN breeding waterbodies, and Fencing during construction would deter casual access to waterbodies. Waterbodies for GCN translocation would be secured as early as possible in order to reduce as far as possible any disturbance effects arising from translocation. 	Neutral
Severance	Operation	<ul style="list-style-type: none"> Staged construction approach. Ten GCN receptor sites included in scheme design. Culverts provided in key areas with dry passages for GCN. Nine dedicated GCN underpasses and ten suitable general use underpasses. 	Neutral
Direct mortality	Construction & operation	<ul style="list-style-type: none"> All potential GCN waterbodies within 250m of the construction corridor would be re-surveyed prior to commencement of the works. Use of barrier and newt fencing to prevent conflicts between with construction site. Where construction activities are likely to adversely affect the functions of GCN waterbodies and terrestrial habitats, translocation under licence from Natural England. Culverts provided in key areas with dry passages for GCN. Nine dedicated GCN underpasses and ten suitable general use underpasses. 	Neutral

Breeding birds

11.5.107 Potential impacts on breeding birds as a result of the scheme include:

- habitat loss;
- changes in environmental conditions (dust);
- disturbance (noise & lighting);
- severance;
- species mortality during construction; and
- species mortality (vehicle collisions).

11.5.108 These impacts are considered to be particularly important at Buckden Gravel Pits CWS (which would be directly impacted by the scheme), due to the presence of two species of county value (cuckoo and Cetti's warbler) and four species of district value (grasshopper warbler, linnet, yellowhammer and yellow wagtail). Cuckoo, Cetti's warbler and grasshopper warbler were not recorded elsewhere within the bird survey area in 2013 or 2014, although these species have been recorded at other local wetland areas including Fenstanton Gravel Pits CWS (adjacent to borrow pit 3 and 400m north of the offline section of the scheme) and Fen Drayton Gravel Pits CWS (1.5km north of the offline section of the scheme).

11.5.109 Additional areas and habitats considered to be important comprise further wetland features adjacent to the scheme that support diverse wetland bird assemblages, areas of arable farmland that support populations of corn bunting, linnet, yellowhammer and yellow wagtail and watercourses (including ditches).

11.5.110 Habitat loss: Foraging, roosting and breeding habitat considered important for breeding birds would be lost as a result of the scheme. As well as reducing the available habitat, this would increase the vulnerability of species to a range of external factors such as adverse weather conditions and predators. The important habitats and corresponding areas of each that would be lost include standing water (4ha), arable (894ha), running water (0.7ha), wet ditches (3.6km), woodland (25ha), scrub/hedgerows (4.1ha/7.8km) and semi improved grassland (77ha). The habitats and corresponding amount that would be potentially lost within Buckden Gravel Pits CWS is standing water (0.3ha), swamp/marginal and inundation habitat (0.3ha) and semi-improved grassland (0.3ha).

11.5.111 A staged approach to construction works would mitigate for habitat loss during the construction period and the loss of <1% of habitats at Buckden Gravel Pits CWS is unlikely to be significant.

- 11.5.112 During operation, impacts resulting from direct habitat loss would be fully mitigated by the design mitigation. This includes creating habitat suitable for use by breeding birds, such as widespread planting of native shrubs and trees and creation of waterbodies such as ponds. By the design year (i.e. 15 years after opening), this planting should be sufficiently mature to provide foraging and nesting habitats for breeding birds. Permanent, slight positive effects are anticipated for birds of local value which would benefit from the increase in semi-natural habitats along the scheme, including semi-natural grassland, wildlife ponds and woodland.
- 11.5.113 The detailed design of the ecology mitigation areas, balancing ponds and landscape planting would comprise habitats that are suitable for breeding birds. This would focus on county or district value species, particularly those that only breed at Buckden Gravel Pits (cuckoo, Cetti's Warbler and grasshopper warbler), i.e. wet woodland, scrub and reed bed. The total area of the breeding habitats created would offset any reduction in breeding habitat at Buckden Gravel Pits and other important areas. These areas would be managed as part of the highways soft estate in order to optimise their value to breeding birds. Restoration of the borrow pits would provide additional bird breeding habitat likely to be of particular value to county or district value species, although beyond the five year scheme maintenance period these may not form part of the permanent Highways Agency soft estate. As such, residual effects during operation on breeding birds of county or district value, which are restricted to Buckden Gravel Pits (i.e. cuckoo, Cetti's warbler and grasshopper warbler) are considered to be neutral in relation to habitat loss.
- 11.5.114 Changes in environmental conditions: The construction phase is likely to result in dust being generated across the site which could potentially result in habitat degradation due to retained vegetation being smothered. Accidental pollution during construction would be of particular concern if it happened in proximity to ecologically sensitive communities or water bodies, potentially resulting in further habitat degradation. However, this would be avoided or reduced to levels which are not significant by general design mitigation. As such, residual effects on breeding birds during construction due to changes in environmental conditions are considered to be neutral.
- 11.5.115 Disturbance (construction): A temporary increase in disturbance during construction is highly likely and this could adversely affect the survival, range and abundance of certain species. Species that are susceptible to disturbance could be displaced and prevented from breeding whilst other species may become habituated to constant levels of relatively predictable disturbance.
- 11.5.116 Design mitigation would minimise disturbance levels. This includes the staged approach to scheme construction and timing the construction works to avoid sensitive breeding times (March to August inclusive) where possible. Cleared areas would be maintained in a condition considered unsuitable for re-colonisation by breeding birds and therefore prevent further disturbance.

- 11.5.117 Noisy activities and night-time working or floodlit works, within a certain distance from existing or potential nest sites, would be restricted, as stated in the general mitigation principles. Construction requirements such as haul routes, material storage areas, compounds, lighting, and generators would be carefully sited and temporary screening would be provided as required. Specifics of this mitigation, along with details of potential breaches of legislation are considered in *Appendix 11.11*. Residual effects on breeding birds during construction due to disturbance are considered to be neutral.
- 11.5.118 Disturbance (operation): The increase in visual stimulus and particularly traffic noise in the area surrounding the scheme could permanently affect breeding birds and their dependent young due to stress. Artificial lighting along roads can alter natural behavioural patterns in both diurnal and nocturnal species of birds, affecting both breeding and foraging behaviour.
- 11.5.119 Due to the estimated high volumes of traffic using the scheme (*Chapter 7*) breeding birds would be affected by noise disturbance for up to 1km from the scheme, *Predicting the effects of motorway traffic on breeding bird populations*. (Reinen, M. et al., 1995). This is therefore likely to impact upon all breeding pairs of important species present at Buckden Gravel Pits.
- 11.5.120 Impacts resulting from disturbance would be reduced as a result of the general mitigation principles. Lighting along the road would be avoided where possible, with required lighting designed in accordance with best practice guidance. Noise barriers in the form of bunds or strategic planting would be installed which would reduce the distance at which breeding birds are affected by the disturbance.
- 11.5.121 As described above, the detailed design of the ecological mitigation areas, balancing ponds and landscape planting would comprise habitats that are suitable for breeding birds. This would focus on habitats suitable for species that are of county or district value.
- 11.5.122 For species such as the Cetti's warbler which is spreading northwards as a result of climate change, it is considered likely that these birds would continue expand their range and increase in numbers in the county and any localised impacts of the scheme should not be reflected in the wider county status of the species.
- 11.5.123 However, uncertainty exists in the responses of birds to noise disturbance and as to whether birds, especially cuckoo, Cetti's warbler and grasshopper warbler would use the ecology mitigation areas to breed to the extent that they fully offset the effects of disturbance. A precautionary approach is therefore applied and residual effects on breeding birds of district and County value during operation due to disturbance are considered to be permanent, moderate adverse.

- 11.5.124 Severance: Habitat severance, leading to fragmentation could negatively impact the conservation status of local bird populations in the long term during the operation of the scheme. Severance would reduce the dispersal of certain species, which results in the isolation of sub-populations and an overall reduction in population size. In general the busier and wider a road the more likely it is to present a barrier to dispersal. Habitat fragmentation may also increase edge effects such as predator risk.
- 11.5.125 Impacts resulting from severance would be mitigated via the general mitigation principles. Key wildlife dispersal corridors and habitat connectivity across the scheme would be maintained. This would be achieved using structural planting (in conjunction with appropriate fencing and sensitive lighting) within the current design. Although the off-line section of the scheme would create north-south severance, the landscape planting and ecological mitigation would create additional connective habitat east-west. Residual effects on breeding birds during the operational phase due to severance are considered to be neutral.
- 11.5.126 Direct mortality (construction): Direct mortality of dependent young and eggs could occur due to certain construction activities, particularly during earthworks.
- 11.5.127 The design mitigation would minimise direct mortality. All habitat clearance would take place outside of the breeding season (March to August inclusive) where possible. Cleared vegetation would be chipped or moved off site to prevent it being used as nesting sites. Cleared areas would be maintained in a condition considered unsuitable for re-colonisation by breeding birds. If vegetation clearance during the breeding season is required it would be undertaken under the supervision of a suitably qualified ecologist. If an active nest is found the clearance works would cease until the young have fledged, with an appropriate exclusion zone put in place. Residual effects on breeding birds during construction due to direct mortality are considered to be neutral.
- 11.5.128 Direct mortality (operation): Certain species of birds are at particular risk of collision with vehicles as they cross active roads at low heights to reach different habitat areas. Vulnerable species include those of the thrush family, owls and game birds. Collisions typically occur where verges or other adjacent areas of busy roads comprise of woodland or scrub habitats.
- 11.5.129 Habitat management of areas of woodland, scrub or grassland on the highway verge should take place outside the main breeding season for birds (March to August inclusive), which would avoid eggs and nesting being lost.
- 11.5.130 New landscape planting that is likely to provide improved nesting/feeding habitats would be set back from the highway. Planting in areas adjacent to the highway would avoid species that provide foraging resources, particularly species such as hawthorn or rowan (*Sorbus aucuparia*) which have an abundance of berries which may attract large numbers of birds, including inexperienced first year individuals.

11.5.131 It is considered unlikely that significant numbers of adult birds of vulnerable species would attempt to cross the road at vehicle height due to the constant high volumes of traffic and width of the road. Any increase in traffic collisions due to the scheme would be partly offset by a likely reduction in fatalities on the existing A14 which would be de-trunked between Ellington and Swavesey, resulting in a reduction in traffic volume.

11.5.132 Residual effects on breeding birds during the operational phase due to direct mortality are therefore considered to be neutral.

11.5.133 A summary of the anticipated effects on breeding birds as a result of the scheme is provided below in *Table 11.25*.

Table 11.25: Summary of assessment of potential impacts and mitigation for breeding birds

Potential Impacts	Construction/Operation	Mitigation	Residual effects
Habitat loss (gain)	Construction & operation	<ul style="list-style-type: none"> • Staged construction approach. • Habitat creation and management at ecological mitigation areas and landscape planting to include specific breeding habitats. Enhancement at borrow pits, although no long term commitment to maintenance. • Standard construction best practice measures. 	Neutral during construction & Slight positive for species of local value/neutral for species of district-County value during operation.
Disturbance	Construction & operation	<ul style="list-style-type: none"> • Construction activities restricted to within a prescribed working corridor and timed to avoid breeding season where possible. • Noisy activities and night-time working or floodlit works restricted. Haul routes, material storage areas, compounds, lighting, generators and other construction requirements to be carefully sited. • Noise barriers in the form of bunds and/or strategic landscape planting along the carriageway would help minimise disturbance to birds from traffic. Lighting along road avoided where possible. • Habitat creation and management at ecological mitigation areas and landscape planting to include specific breeding habitats would help offset disturbance impacts. Enhancement at borrow pits although no long term commitment to maintenance. 	Neutral & moderate adverse
Direct mortality	Construction & operation	<ul style="list-style-type: none"> • Habitat clearance would take place outside of the breeding season where possible, or under supervision of experienced ecologist. • New landscape planting that is likely to provide improved nesting/feeding habitats should be set back from the highway. Any planting in areas adjacent to the highway should not comprise of species that provide significant foraging resources. • De-trunking of existing A14 between Ellington and Swavesey, 	Neutral
Severance	Operation	<ul style="list-style-type: none"> • Key wildlife dispersal corridors and habitat connectivity would be maintained 	Neutral

Wintering birds

11.5.134 Potential impacts on wintering birds as a result of the scheme include:

- habitat loss;
- disturbance;
- severance; and
- species mortality (vehicle collisions).

11.5.135 These impacts would be particularly important to address at Buckden Gravel Pits CWS, due to the presence of three species of county vale (bittern, goldeneye and shoveler) and one species of district value (pochard).

11.5.136 Habitat loss: Foraging and roosting habitat considered important for wintering birds would be lost as a result of the scheme. As well as reducing the available habitat, this would increase the vulnerability of species to a range of external factors such as adverse weather conditions and predators. The important habitats and areas of each that would be lost includes standing water (4ha), arable (894ha), improved grassland (15ha), amenity grassland (6ha), running water (0.7ha), wet ditches (3.6km), woodland (25ha), scrub/hedgerows (4.1ha/7.8km) and semi improved grassland (77ha). The habitats and corresponding amount that would be lost within Buckden Gravel Pits CWS is standing water (0.3ha), swamp/marginal inundation habitat (0.3ha) and semi improved grassland (0.3ha).

The loss of arable land and improved grassland during construction of the scheme is highly unlikely to affect the conservation status of over wintering species that these habitats support, such as fieldfare, lapwing, black-headed gull and starling, due to the large area of these habitats present in the wider area.

11.5.137 A staged approach to construction works would mitigate for habitat loss during the construction period and the loss of <1% of habitats at Buckden Gravel Pits CWS is unlikely to be significant.

11.5.138 Habitat creation would include widespread planting of native shrubs and trees that fruit in late autumn/winter. By the design year (15 years after opening), this planting should be sufficiently mature to provide foraging habitat for wintering passerine birds.

- 11.5.139 During operation, the detailed design of the ecological mitigation areas, balancing ponds and landscape planting would comprise habitats that are suitable for wintering birds. This would focus on habitats suitable for species that are of county or district value and are limited within the survey area, such as standing water and reed beds. These areas would be subject to long term management as part of the highways soft estate in order to optimize their value to wintering birds. Restoration of the borrow pits would provide additional wintering bird habitat, although beyond the scheme maintenance period of five years, these may not form part of the permanent Highways Agency soft estate. As such, residual effects on wintering birds during operation due to habitat loss are considered to be neutral.
- 11.5.140 Disturbance (construction): A temporary increase in disturbance during construction could adversely affect the survival, range and abundance of certain species of wintering birds.
- 11.5.141 The general design mitigation would minimise disturbance levels. Noisy activities and night-time working or floodlit works would be restricted to a prescribed working corridor, as stated in the general mitigation principles. Construction requirements such as haul routes, material storage areas, compounds, lighting and generators would be carefully sited and temporary screening would be provided as required. Specifics of this mitigation, along with details of protective legislation are considered in *Appendix 11.11*.
- 11.5.142 Residual effects on wintering birds during construction due to disturbance are considered to be neutral.
- 11.5.143 Disturbance (operation): The increase in visual stimulus and traffic noise in the area surrounding the scheme could permanently affect wintering birds due to stress. Artificial lighting along roads can alter natural behavioural patterns in both diurnal and nocturnal species of birds, affecting foraging and roosting behaviour. Species that are susceptible to disturbance could be displaced whilst other species may become habituated to constant levels of relatively predictable disturbance.
- 11.5.144 Due to the estimated high volumes of traffic using the scheme (*Chapter 7*) wintering birds could be affected by noise disturbance for up to 1km from the scheme, *Predicting the effects of motorway traffic on breeding bird populations* (Reinen, M. et al., 1995). This is therefore likely to impact upon all important species present, and particularly at Buckden Gravel Pits.
- 11.5.145 Impacts resulting from disturbance would be reduced as a result of the general mitigation principles. Lighting along the road would be avoided where possible, with required lighting designed in accordance with best practice guidance. Noise barriers in the form of bunds would be installed which would reduce the distance at which wintering birds are affected by the disturbance.

- 11.5.146 The detailed design of the ecological mitigation areas and landscape planting would comprise habitats that are suitable for certain species of wintering birds including bittern, goldeneye, shoveler and pochard. The total area of wintering bird habitats created along the scheme in the ecological mitigation areas would provide mitigation for any reduction in wintering bird densities which may arise due to noise disturbance from the scheme and no significant effects are considered likely for wintering birds as a result of disturbance during operation.
- 11.5.147 Severance: Habitat severance, leading to fragmentation is likely to negatively impact the conservation status of local populations of wintering birds in the long term. Habitat fragmentation may also increase edge effects such as predator risk. In general the busier and wider a road the more likely it is to present a barrier to dispersal. However, the majority of species would not alter their flight behaviour and they would still be able to disperse to areas either side of the scheme.
- 11.5.148 Any impacts resulting from severance are screened out due to the general mitigation principles. Key wildlife dispersal corridors and habitat connectivity across scheme would be maintained. This would be achieved using, structural planting (in conjunction with appropriate fencing and sensitive lighting) within the current design. Although the off-line section of the scheme would create north-south severance, the landscape planting and ecological mitigation would create additional connective habitat east-west. Residual effects on wintering birds during the operational phase due to severance are considered to be neutral.
- 11.5.149 Direct mortality: Certain species of birds are at particularly risk of collision with vehicles as they cross active roads at low levels to reach different habitat areas. Vulnerable species include those of the thrush family, owls and game birds. Collisions typically occur where verges or other adjacent areas of busy roads comprise of woodland or scrub habitats.
- 11.5.150 New landscape planting that is likely to provide improved feeding habitats should be set back from the highway. Planting in areas adjacent to the highway would not comprise of species that provide foraging resources, particularly species such as hawthorn or rowan which have an abundance of berries which may attract large numbers of birds, including inexperienced first year individuals.
- 11.5.151 It is considered unlikely that significant numbers of adult birds of vulnerable species would attempt to cross the road at vehicle height due to the constant high volumes of traffic and width of the road. Any increase in traffic collisions due to the scheme would be partly offset by a likely reduction in collisions on the existing A14 which would be de-trunked between Ellington and Swavesey, resulting in a reduction in traffic volume. Residual effects on wintering birds during the operational phase due to direct mortality are considered to be neutral.
- 11.5.152 A summary of the anticipated effects on wintering birds as a result of the scheme is provided below in Table 11.26.

Table 11.26: Summary of assessment of potential impacts for wintering birds

Potential Impacts	Construction/ Operation	Mitigation	Residual effects
Habitat loss (gain)	Construction	<ul style="list-style-type: none"> • Staged construction approach • Habitat creation and management at ecological mitigation areas, balancing ponds and landscape planting to include specific habitats. • Standard construction best practice measures. Enhancement at borrow pits, although no long term commitment to maintenance. 	Neutral
Disturbance	Construction & operation	<ul style="list-style-type: none"> • Construction activities restricted to within a prescribed working corridor. • Noisy activities and night-time working or floodlit works restricted. Haulage routes, material storage areas, compounds, lighting, generators and other construction requirements to be carefully sited. • Noise barriers in the form of bunds and/or strategic landscape planting along the carriageway would help minimise disturbance to birds from traffic. Lighting along road avoided where possible. • Where necessary, construction activities that result in constant levels of visual and/or audial disturbance programmed so that the duration gradually increases. • Habitat creation and management at ecological mitigation areas and potentially at borrow pits to include specific wintering habitats would help offset disturbance impacts. 	Neutral
Direct mortality	Construction & operation	<ul style="list-style-type: none"> • New landscape planting that is likely to provide improved wintering habitats should be set back from the highway. Any planting in areas adjacent to the highway should not comprise of species that provide significant foraging resources. • De-trunking of existing A14 between Ellington and Swavesey. 	Neutral
Severance	Operation	<ul style="list-style-type: none"> • Key wildlife dispersal corridors and habitat connectivity would be maintained. 	Neutral

Barn owl

11.5.153 Potential impacts on barn owls as a consequence of the schemes include:

- habitat loss (including nesting sites);
- disturbance;
- severance; and
- direct mortality (vehicle collisions).

11.5.154 Habitat loss: A total of 8.4ha of optimal foraging habitat and 24.9ha of sub-optimal foraging habitat would be permanently lost as a result of the scheme. One confirmed breeding site (located adjacent to the A1 (southbound); reference number 4), and two potential breeding sites (located to the south of A14 at Brampton Hut; reference number 15 and east of the river Great Ouse; reference number 41) would be lost or heavily disturbed due to the scheme (*Appendix 11.7*). A further 11 potential nest sites (reference numbers 16, 26, 27, 34, 35, 36, 42, 53, 68, 80 and 95) could be subject to disturbance from construction activities (*Figure 11.8*).

11.5.155 Active and potential nest sites would be re-surveyed by an ecologist with a barn owl disturbance licence in order to determine those that are in use and therefore if compensation is required. This would be undertaken during May and August in the year prior to the commencement of any construction activities, including clearance works. Specifics of mitigation regarding nest sites, along with details of protective legislation are considered in *Appendix 11.11*.

11.5.156 Habitat suitable for use by foraging barn owls would be created as part of the scheme, much of which would be created in advance of construction. This would be within the ecological mitigation areas (*Figure 11.13*). This would ensure that there is no net loss of semi-natural habitats that are of value to barn owls. These areas would be subject to long term management in order to optimize their value to barn owls.

11.5.157 In order to increase nesting opportunities, a number of barn owl boxes or towers would be erected at least one year prior to the commencement of any construction activities. The locations and numbers would be decided after further consultation with the Barn Owl Trust.

11.5.158 Residual effects on barn owls during construction due to habitat loss are considered to be neutral.

11.5.159 Disturbance (construction): A temporary increase in general disturbance would occur as a result of construction, which could adversely affect any breeding barn owls or their dependent young. It is also possible that the local population may not recover from construction impacts due to the potential ongoing effects of the operational phase of the scheme.

- 11.5.160 Design mitigation would minimise disturbance levels. This includes a phased approach to construction and timing the construction works in the vicinity of breeding barn owl to avoid sensitive breeding times for barn owl, with April to August considered to be particularly sensitive. Noisy activities and night-time working or floodlit works would be restricted, as stated in the general mitigation principles, within an appropriate distance from existing or potential nest sites during construction. Temporary screening within the vicinity of active nest sites would be provided as required. Specifics of this mitigation, along with details of potential breaches of legislation are considered in *Appendix 11.11*. Haul routes, material storage areas, compounds, lighting, generators and other construction requirements would be carefully sited.
- 11.5.161 Residual effects on barn owls during construction due to disturbance are considered to be neutral.
- 11.5.162 Disturbance (during operation): The increase in traffic noise in the area surrounding the scheme is likely to permanently increase the general disturbance levels for barn owls. This could adversely affect any breeding barn owls or their dependent young during the operational phase.
- 11.5.163 Disturbance due to visual and noise stimulus would be minimised through sensitive tall screen planting, as stated in the general guidance mitigation. The provision of nest boxes and additional foraging habitat would also offset disturbance effects on the population.
- 11.5.164 Residual effects on barn owls during operation due to disturbance are considered to be neutral.
- 11.5.165 Direct mortality: Direct mortality due to collision with moving traffic during the operational phase is likely and could have a permanent impact on the conservation status of this species as it is considered to be particularly vulnerable due to its foraging method.
- 11.5.166 To help prevent direct mortality of barn owls, the design mitigation includes sensitive planting along the road verge in order to deter barn owls from foraging near to the road. A grass sward considered to be unattractive to foraging barn owls would be maintained on the verges directly adjacent to the highway, where practicable. In addition tall screen planting in key locations would be used to elevate the path of barn owls over the road above traffic height. This would be particularly important at locations known as barn owl mortality 'blackspots', of which there are considered to be six along the scheme (*Figure 11.13*).
- 11.5.167 The increase in traffic collisions due to the scheme would be partly offset by a likely reduction in collisions on the existing A14 which would be de-trunked between Ellington and Swavesey resulting in a reduction in traffic volume.

- 11.5.168 Nesting opportunities would also be increased with a number of barn owl boxes or towers erected, at least one year prior to the commencement of any construction activities. The locations and numbers would be decided after further consultation with the Barn Owl Trust. This is considered sufficient to compensate for any population declines that may be a result of road mortalities on the scheme as it is thought that availability of nest sites is more likely to be limiting factor to the population than road deaths.
- 11.5.169 Residual effects on barn owls during operation due to direct mortality are considered to be neutral.
- 11.5.170 Severance: Severance is likely to permanently affect the population of barn owls in the area surrounding the road during operation by limiting any potential replacement of lost barn owls by migration from outside the study area.
- 11.5.171 Crossing provision for barn owls (i.e. elevating the owls' flight path above the height of the traffic to minimise the risk of mortality through collision) would be achieved by sensitive tall screen/guidance planting etc., as stated in the general guidance mitigation. Although the offline section of the scheme would create north-south severance, the landscape planting and ecological mitigation would create additional connective habitat east-west.
- 11.5.172 Residual effects on barn owls during operation due to severance are considered to be neutral.
- 11.5.173 A summary of the anticipated effects on barn owl as a result of the scheme is provided below in *Table 11.27*. Following the implementation of scheme mitigation all effects on barn owls during the construction and operational phases are considered to be neutral.

Table 11.27: Summary of assessment of potential impacts and mitigation for barn owl

Potential Impacts	Construction/ Operation	Mitigation	Residual effects
Habitat loss (gain)	Construction	<ul style="list-style-type: none"> • Pre-construction surveys to identify all nest sites in use • Creation of semi-natural habitats suitable for barn owl • Erection of barn owl boxes one year prior to construction commencing. 	Neutral
Disturbance	Construction & operation	<ul style="list-style-type: none"> • Staged construction approach • Avoid construction works during sensitive breeding period (April-August) in vicinity of breeding barn owl. • Noisy activities and night-time working or floodlit works restricted in vicinity of breeding barn owl. • Haul routes, material storage areas, compounds, lighting, generators and other construction requirements to be carefully sited. • Temporary screening of active nest sites. • Sensitive tall screen planting. • Provision of nest boxes and additional foraging habitat. 	Neutral
Direct mortality	Construction & operation	<ul style="list-style-type: none"> • Sensitive planting to deter barn owl from foraging along near the road. • Tall screen planting to elevate the path of barn owl above the height of traffic. • De-trunking of existing A14 between Ellington and Swavesey. • Increased nesting opportunities. 	Neutral
Severance	Operation	<ul style="list-style-type: none"> • Key wildlife dispersal corridors and habitat connectivity would be maintained north-south. • Landscape planting and ecological mitigation would create additional connective habitat east-west 	Neutral

Bats

11.5.174 The following pathways to impacts have been identified for bats:

- habitat loss;
- changes in environmental conditions;
- disturbance;
- severance;
- species mortality during construction;
- species mortality (vehicle collisions); and
- road lighting (disturbance, degradation in foraging habitat, increased abundance of prey).

11.5.175 Habitat loss: Bats would be affected by the scheme through loss of roost sites and loss of foraging habitat. The scheme would result in the loss of three brown long-eared bat tree roosts (BT2.3, BT2.4 and J2.1, *Figure 11.10* for bat roost locations) and one pipistrelle species tree roost (T9.1) due to their location within the construction footprint. The loss of five further tree roosts is also possible due to their location on the periphery of the construction footprint; these include three common pipistrelle roosts (tree 21 and an unnamed tree identified in woodland 7, plus the tree adjacent to the river Great Ouse identified by Atkins in 2008) and two soprano pipistrelle roosts (tree BT6.3c and an unnamed tree identified in woodland 7). All of the roosts have been determined to be summer, non-breeding roosts used infrequently by small numbers of common bat species and have been valued at local level.

11.5.176 In addition to the known tree roosts listed above, there would be loss of 13 category 1* trees (9, 1, 2, 30, BT3.10, BT4.6, BT4.5b, BT5.10B, K5.19, K5.9, K3.2, J2.12 and J2.17) and potential loss of a further six category 1* trees (BT3.3, BT4.7a, BT4.4D, BT8.1, 51, and T8.10) which are on the periphery of the construction footprint.

11.5.177 There would also be a loss of 57 category 1 trees (24, 6, 8, 10a, 10, 11, 12, 13, 38, 31, 37, 36, BP2.2, BP2.3, BT.2, BT2.4c, BT2.4a, BT2.4B, BT4.3a, BT4.7, BT4.7d, BT5.6, BT5.2, BT5.0a, N5.1, N4.2, N4.1, K5.20, K5.26, K5.17, K5.16, K5.30, K5.31, K5.14, K5.7, K5.5, K5.4, K5.3, K5.1, SA10.2, N1.1, J3.8, J3.9, J2.13, J2.7, J2.8, T5, T6, T8.1, N7.2, N7.1) and a possible loss of a further 12 category 1 trees (BT3.12, BT4.7B, BT4.4E, BT8.4A, J4.2, J4.3, J4.4, SA17.5, SA17.11, T8.8, T8.12 and BT12.9b) which are on the periphery of the construction footprint. Surveys have found no evidence to suggest current use of these trees by roosting bats however they have been identified as having potential for use by bats, and could provide potential roost sites in the future even if not in use at the current time.

11.5.178 A Natural England licence would be required in respect of any roost destruction (*Appendix 11.11*). Impacts to bats through the loss of these trees would be mitigated by:

- Re-survey of category 1 and 1* trees prior to construction to update the baseline data, ensuring any new roosts are identified before site clearance.
- Protection and retention of trees on the periphery of the construction footprint where practical.
- Provision of replacement habitat through planting trees and woodland to offset loss of potential roost features in the long term. Planting would be undertaken prior to construction or at the earliest opportunity during construction.
- Prior to clearance of habitats, provision of additional bat boxes throughout retained woodland and trees within the scheme to offset the loss of potential roost features in the short term. A minimum of three bat boxes to be provided for every category 1 or 1* tree to be lost. Boxes would be made of woodcrete and would be a range of box designs including maternity boxes, hibernation boxes and boxes designed for crevice dwelling species given the presence of barbastelles within the local area. A minimum of 200 boxes would be installed in line with the HABAP.
- Creation of roost features in retained standing deadwood, through creation of slits with chainsaws.
- Provision of artificial bat roost sites within the new West Brook Bridge and the Ellington Brook Bridge through inclusion of integral bat boxes (number and design to be determined at detailed design).

11.5.179 None of the buildings containing bat roosts would be directly impacted by the scheme. Building B.31 (The Cottage, Offord Road) is located immediately adjacent to a stretch of road due to be realigned. For the purpose of this assessment it is assumed building B.31 would be retained and therefore there would be no loss of bat habitat for this aspect of the scheme.

11.5.180 No roosts have been identified within culverts or bridges so there would be no habitat loss impacts on bats resulting to works on these structures. In addition, a commitment has been made to retain structures along the route with moderate, or greater, bat roost potential to maintain roosting habitat in the long term.

11.5.181 Areas of woodland habitat of moderate to high value for bats, to be lost as a result of vegetation clearance to enable construction are summarised in *Table 11.28* below.

Table 11.28: Habitat losses from high and moderate value woodlands

Value of habitat to bats	Wood ref.	Total area (ha)	Area to be lost (ha)
High	1	0.37	0.06
	2A	1.27	0.03
	3	1.00	0
	5	0.82	0.6
	7	1.91	0.31
	Sub-total	5.37	1
Moderate	2B	1.23	0.09
	4a	0.60	0
	4b	0.67	0.01
	9	3.10	0.04
	Sub-total	5.6	0.14
Assumed high (no access)	6	6.34	0.02
	8	8.69	0.03
	Sub-total	15.03	0.05

11.5.182 The construction of the scheme would also result in loss of other habitat of value to foraging bats including broadleaved woodland, hedgerows, grassland and watercourses (*Table 11.21*). Loss of these habitats would be mitigated through creation of significant areas of replacement habitat (*Table 11.21*) with woodland (65ha) and semi-improved grassland (200ha) both having notable permanent net gains. Currently the surrounding landscape is predominantly arable habitat; however construction of the scheme would result in a significant amount of new semi-natural habitat (271ha) which would be highly beneficial to bats. Some of these habitats would be created in advance of construction to provide receptor areas for GCN and other species, whereas other landscaping would be planted upon completion of construction.

11.5.183 New waterbodies created for GCN, SuDS waterbodies, balancing waterbodies and swales would be designed to have a secondary biodiversity function that would support invertebrate prey providing foraging habitat for bats. Where groundwater and topographic conditions are suitable, borrow pits would be restored to provide habitat gains, although any habitat gains obtained in borrow pit areas must be considered temporary, as previously discussed in *Section 11.4*.

- 11.5.184 Due to the time lag between clearance of habitats to enable construction, and planting of new habitats upon completion of the scheme there would be a temporary, moderate adverse effect from loss of foraging habitat on bats. Provision of alternative roost sites (bat boxes) would be completed in advance of habitat clearance and therefore no significant effects are anticipated as a result of loss of roost sites and effects are considered neutral for roosting bats. Habitat creation would result in a permanent, moderate beneficial effect on foraging and roosting bats.
- 11.5.185 Changes in environmental conditions: Existing waterbodies within the scheme provide high quality foraging habitat for a range of bat species due to the invertebrate fauna they support. Changes in the quality of waterbodies may lead to a decrease in invertebrate prey. Proximity of waterbodies to soil storage areas, borrow pits and construction sites has the potential to alter the nutrient status of waterbodies and to change vegetation communities as a result of dust deposition, overland flow of soil particles and deposition of vehicle-sourced pollutants.
- 11.5.186 There is also the potential for indirect impacts to bats through bioaccumulation of toxins acquired through feeding on contaminated prey, *Heavy metals and metallothionein in vespertilionid bats foraging over aquatic habitats in the Czech Republic* (Pikula et al., 2010). Pollutants transported by surface water flows from construction works and operational highways have the potential to affect bats through lethal and sub-lethal effects on the species.
- 11.5.187 Design mitigation measures during construction would prevent significant effects on waterbodies from airborne nutrients and pollutants (as summarised in *Section 11.4* and within *Appendix 20.2*). Impacts on bats arising from changes in environmental conditions are screened out as a significant effect.
- 11.5.188 Disturbance: Noise and vibration during construction have the potential to impact on bats while roosting during the day by causing premature departure from the roost during daylight hours, potentially leading to increased mortality of bats as they would be more vulnerable to predation during the day. Bats may also be impacted as roosts may become temporarily unsuitable for use during the period over which disturbance occurs, resulting in a temporary loss of roost sites. There is also potential for bats to be impacted by noise and vibration when active at night during construction as there are significant areas of the scheme where night-time working is required, primarily on the online sections and Huntingdon Town Centre viaduct, due to the requirement for traffic management and rail line closures. This has potential to deter bats from commuting and foraging within habitats where noise levels are increased as it may affect their ability to echolocate, particularly species which rely on listening for their prey such as long eared bats.

- 11.5.189 Disturbance of roosts would be mitigated through design mitigation by the installation of protective fencing around retained vegetation (as detailed in *Appendix 20.1* and *Appendix 20.2*). The protection zone around known roosts on the periphery of the works areas would be designed to provide the maximum protection possible. These zones would be determined by the ecological clerk of works at the start of construction.
- 11.5.190 The implementation of other general mitigation measures such as compliance with *BS 5228: Noise control on construction sites and open sites (Part 1: Noise (BS5228, Part 1, 2009 + A1: 2014)* (BSI, 2014a) and *BS5228 Part 2: :2009+A1:2014 Code of Practice for noise and vibration control on construction and open sites – Part 2: Vibration.* (BSI, 2014) and those measures detailed for sensitive receptors would also mitigate impacts from noise and vibration preventing departure of bats from roosts during daylight hours and reducing impacts to foraging and commuting bats.
- 11.5.191 A more specific measure to offset the temporary loss of roost sites would be the provision of bat boxes in areas of suitable habitat along the length of the scheme, in retained habitats furthest from the road where impacts from noise and disturbance would be reduced.
- 11.5.192 Construction impacts on bats via disturbance would be restricted to localised areas, would be temporary and taking into account the proposed mitigation are unlikely to have a significant effect on the local population.
- 11.5.193 There is potential for bats to be impacted by increased disturbance from noise and vibration during operation of the road, particularly in habitats adjacent to the off-line section. This may affect roosting bats, but also has the potential to impact commuting and foraging bats (particularly species which depend on listening for their prey such as brown long-eared bats).
- 11.5.194 There is limited research on the effect of road noise on bats. Shaub et al. (2008) found noise levels had an effect on the foraging behaviour of greater mouse-eared bats (*Myotis myotis*). This species listens for its prey (as opposed to detecting echolocation calls) and therefore it is reasonable to assume other bat species which utilise the same predatory mechanism, such as brown long-eared bats, may be similarly affected. Berthinussen and Altringham (2012) found a marked increase in bat activity as distance from a major road increased, however they were unable to attribute this to noise, and the precise cause of this pattern is uncertain.
- 11.5.195 Disturbance of roosts during operation of the road would be mitigated through the provision of bat boxes in areas of suitable habitat along the length of the scheme, in retained habitat furthest from the road in advance of construction, and also through provision of new planting in areas furthest from the road to provide alternative roost sites and foraging habitat once planting has matured. Replacement habitats would be planted at the earliest opportunity prior to, during and after construction, based on the staged approach to construction, to ensure habitats are available for use as soon as is feasible in line with the construction programme.

11.5.196 Field survey results have identified the following key areas for foraging and/or commuting bats:

- river Great Ouse and Buckden Gravel Pits (transect 3);
- land east and west of the A1198, between Wood Green Animal Shelter and Debden Lodge (transect 5);
- land southwest of the A14, adjacent to Cambridge Crematorium (transect 13);
- lake north of the A14, west of Impington Guided Busway (transect 19);
- Static detector 5 (between A1 and Brampton Wood);
- Static detector 6 (adjacent to A1 and fishing lakes, east of Brampton Wood);
- Static detector 6A (A1 overbridge east, south east of Brampton Wood);
- Static detector 8 (south east of Brampton Wood);
- Static detector 10 and 11 (Buckden Gravel Pits);
- Static detector 12 (river Great Ouse);
- Static detector 22 (B1040, south west of Fenstanton Gravel Pits);
- Static detector 28 (track east of sewage works, north of A14); and
- Static detector 41 (adjacent to A1 and west of fishing lakes).

11.5.197 Planting would be provided in these areas to provide a barrier between noise from the road and adjacent habitats where bats may be foraging, reducing the impact of disturbance. These areas of planting would be incorporated at detailed design.

11.5.198 Impacts on bats arising from disturbance during construction are screened out as having a significant effect, however applying a precautionary approach (in the absence of further research on the effect of noise on bats), it is possible there would be residual moderate adverse effects from noise disturbance to local bat populations during operation of the road.

11.5.199 Severance: Construction works, and particularly the offline section of the scheme, has the potential to result in loss of navigational features used by bats travelling to important areas of foraging, socialising and roosting habitat. Key navigational features typically used by bats include hedgerows, tree lines and watercourses. Field surveys have shown the following areas are particularly valuable for commuting bats within the site:

- Impington Guided Busway Bridge (Feature 6) – common and soprano pipistrelles recorded commuting under the bridge under the A14.

- Girton A14 Bridge West (Feature 14) - common and soprano pipistrelles recorded commuting under the footbridge under the M11.
- Huntingdon Life Sciences Northern Culvert (Feature 28) – common pipistrelles commuting under the A1.
- Northern culvert (Feature 29) - common pipistrelles commuting under the A1.
- Ellington Brook (Feature 31) – soprano pipistrelles commuting over the A1, *Nyctalus sp.* And brown long-eared bats commuting through the culvert.
- A1 Overbridge (Feature 37) – common and soprano pipistrelles commuting under bridge. Soprano pipistrelles commuting over A1.
- river Great Ouse and Buckden Gravel Pits (transect 3).
- Land east and west of the A1198, between Wood Green Animal Shelter and Debden Lodge (transect 5).
- Land southwest of the A14, adjacent to Cambridge Crematorium (transect 13).
- Lake north of the A14, west of Impington Guided Busway (transect 19).
- Static detector 5 (between A1 and Brampton Wood).
- Static detector 6 (adjacent to A1 and fishing lakes, east of Brampton Wood).
- Static detector 6A (A1 overbridge east, south east of Brampton Wood).
- Static detector 8 (south east of Brampton Wood).
- Static detector 10 and 11 (Buckden Gravel Pits).
- Static detector 12 (river Great Ouse).
- Static detector 22 (B1040, south west of Fenstanton Gravel Pits).
- Static detector 28 (track east of sewage works, north of A14).
- Static detector 41 (adjacent to A1 and west of fishing lakes).

11.5.200 Impacts on bats from severance would be mitigated through the following measures (see *Figure 11.13* and *Appendix 20.1*) for details of the locations:

- Maintenance of important bat commuting routes and foraging areas along the river Great Ouse corridor through sensitive design of the new river Great Ouse crossing which would be of sufficient height to allow free movement of bat species beneath it.
- Maintenance of north to south commuting corridors through provision of a new large bore culvert at Grafham Road, and a large box culvert between chainages 28,750 and 28,8800 in addition to further oversized culverts suitable for use by bats (*Figure 11.13*).

- Design of existing culverts requiring extension to maximise the diameter of culverts.
- Linear planting to guide bats to culvert crossing points.
- Provision of bat hop-overs through structural planting.
- New high quality habitat creation and management.

11.5.201 The above mitigation actions would reduce the impacts of severance north-south and the creation of habitat corridors along the east-west axis of the road would greatly improve connectivity in this direction. It is assessed that design mitigation planting would provide a beneficial impact which would offset the impact of severance from north-south and overall the impact of severance is assessed as being neutral.

11.5.202 Species mortality during construction: No known bat roosts within structures (buildings, bridges and culverts) have been identified during field surveys. Pre-construction surveys would update baseline information for structures with moderate and high roost potential which would be directly impacted. Should these structures become utilised by bats in the interim, a Natural England license would be required (*Appendix 11.11*) and mitigation would be implemented to prevent mortality of bats during construction.

11.5.203 A minimum of four and maximum of nine, known tree roosts would be felled to enable construction. If bats are present within roosts during felling operations, this would have the potential to cause mortality of bats. Impacts to bats would be mitigated through:

- Pre-construction surveys of trees would be undertaken for tree roosts with moderate and high potential to determine the current use of trees by bats for those trees to be felled.
- Felling operations to be conducted in accordance with a method statement (which would be licensed to ensure legal compliance).
- Works would be timed to avoid the seasons when bats are most likely to be present.
- Bats would be excluded before felling.
- Trees would be soft felled.
- Works would be conducted under the supervision of a licenced bat ecologist.

11.5.204 Given the mitigation proposed, impacts on bats arising from mortality during construction are screened out as a significant effect.

11.5.205 Species mortality (vehicle collisions): There is potential for mortality of bats during the operation of the road due to collisions with vehicles. Collisions are most likely to occur at:

- each point that the new road crosses an existing bat commuting route;

- where changes along the existing route cause bats to cross the road at a reduced height; or
- where the road width has increased allowing additional lanes of traffic.

11.5.206 Field surveys have identified several key areas for foraging and commuting bats which cross the alignment of the road.

11.5.207 Species mortality through vehicle collisions would be mitigated through:

- Provision of lengths of tall and dense vegetation planting alongside the carriageway to elevate the flight path of bats over the height of heavy goods vehicles.
- Sensitive design of new and extended culverts to maximise the diameter of these structures, providing safe routes under the road.
- Provision of planting to guide bats to safe crossing points (hop-overs and culverts).

11.5.208 The above mitigation actions should reduce the impacts of vehicle collisions however it is uncertain if these actions would be sufficient to ensure deaths via collisions do not have significant effects on local bat populations. A precautionary approach to the assessment has therefore been applied and the residual effects on bats during operation due to vehicle collisions are considered to be permanent, moderate adverse.

11.5.209 Road lighting: Road lighting has the potential to cause both positive and negative effects on bats as different species react differently to lighting.

11.5.210 Should roost exits be lit, emergence is likely to be delayed, shortening the time available for foraging, *Artificial lighting and wildlife, Interim Guidance: Recommendations to help minimise the impact artificial lighting* (BCT, 2014).

11.5.211 Some invertebrate species are attracted to artificial lighting (Bruce-White and Shardlow, 2011). This has the potential for adverse impacts on invertebrate populations as they become disorientated and exhausted, and it is possible egg laying females are mistakenly attracted away from water bodies. It is estimated one third of invertebrates attracted to external lights will die as a result of their encounter, *Artificial lighting and wildlife, Interim Guidance: Recommendations to help minimise the impact artificial lighting* (BCT, 2014). This effect could over time lead to a reduction in the abundance of invertebrate prey which may indirectly impact bats.

11.5.212 Some species such as noctule, serotine, Leisler's and pipistrelle bats would benefit from increased lighting as they are able to forage prey which are attracted to it, therefore these species may be positively impacted by road lighting, *Artificial lighting and wildlife, Interim Guidance: Recommendations to help minimise the impact artificial lighting* (BCT, 2014).

11.5.213 However road lighting is likely to cause many species of bats (particularly slow flying, broad winged species including long-eared bats, *Myotis* species and barbastelles) to avoid the illuminated area potentially resulting in a direct loss of foraging and/ or roosting habitat. Road lighting may also act as a barrier to commuting and therefore prevent bats accessing important areas that are present beyond the road.

11.5.214 Finally, bats have the potential to be indirectly adversely affected by road lighting due to impacts on invertebrate prey as it is thought road lighting attracts invertebrates from further afield and therefore may cause a reduction of the availability of prey in adjacent habitats, *Artificial lighting and wildlife, Interim Guidance: Recommendations to help minimise the impact artificial lighting* (BCT, 2014).

11.5.215 Bats have the potential to be impacted by road lighting during both construction and operation of the road due to the requirement for night-time working during construction.

11.5.216 Impacts to lighting during construction would be mitigated through:

- use of hoods and shields to limit light spill onto adjacent habitats;
- downward directional lighting to the area to be illuminated; and
- lighting shall be the minimum brightness required for health and safety.

11.5.217 Construction impacts would be limited to relatively localised areas, would be temporary and are not anticipated to have a significant effect on bat populations.

11.5.218 Impacts to bats during operation of the road would be mitigated through avoidance as part of the scheme design via reduced lighting. Lighting is limited to junctions on the scheme only. Where lighting is necessary it would be in accordance with *Bats and lighting in the UK, Bats and the Built Environment Series*. (BCT, 2009) and *Interim Advice Note 116/09: Nature Conservation Advice in Relation to Bats* (Highways Agency, 2008). Planting would be provided in these lit areas to shield adjacent habitats from lighting. In addition, close board fencing would temporarily be provided in areas adjacent to sensitive habitats until planting has matured. Lighting in the vicinity of retained roosts would be directed to ensure roost exits are not lit. Impacts on bats arising from disturbance from lighting conditions during operation are screened out as a significant effect.

11.5.219 *Table 11.29* provides a summary of the impact assessment for bats.

Table 11.29: Summary of assessment of potential impacts and mitigation for bats

	Construction/ Operation	Mitigation	Residual effects
Habitat loss (gain)	Construction & operation	<ul style="list-style-type: none"> • Pre-construction survey of category 1 and 1* trees. • Protection and retention of trees on the periphery of the construction footprint. • Provision of replacement habitat through planting trees and woodland. Planting would be undertaken prior to construction or at the earliest opportunity during construction. • Prior to clearance of habitats, provision of additional bat boxes throughout retained woodland and trees within the scheme. A minimum of three bat boxes to be provided for every category 1 or 1* tree to be felled. A minimum of 200 boxes should be installed in line with the HABAP. • Creation of roost features in retained standing deadwood, through creation of slits with chainsaws. • Provision of artificial bat roost sites within bridges and other new structures. • Habitat creation and management at ecological mitigation areas and landscape planting to include foraging and commuting habitats. Enhancement at borrow pits. • Standard construction best practice measures. 	Moderate adverse (temporary) for foraging bats, Moderate beneficial (permanent) for roosting and foraging bats
Changes in environmental conditions	Construction & operation	<ul style="list-style-type: none"> • Implementation of design mitigation measures. 	Neutral
Disturbance	Construction & operation	<ul style="list-style-type: none"> • Installation of protective fencing around retained roosts. • Implementation of design mitigation measures. • Provision of bat boxes in areas away from the road to provide alternative roost sites. • Provision of planting in areas away from the road to provide alternative natural roosts in the long term. • Planting between the road and areas of high value for bats to reduce disturbance during operation of the road. 	Neutral & moderate adverse (permanent)

	Construction/ Operation	Mitigation	Residual effects
Severance	Operation	<ul style="list-style-type: none"> • Maintenance of important bat commuting routes and foraging areas along the river Great Ouse corridor through sensitive design of the new river Great Ouse crossing. • Maintenance of north-south commuting corridors through provision of new culverts, including large bore culvert at Grafham Road, and a large box culvert between chainages 28,750 and 28,8800. • Design of existing culverts requiring extension to maximise the diameter of culverts. • Provision of bat hop-overs. • New high quality habitat creation and management. • Linear planting to guide bats to culvert crossing points. 	Neutral
Direct mortality	Construction & operation	<ul style="list-style-type: none"> • Undertake pre-construction surveys to update baseline. • Felling operations to be conducted in accordance with a method statement (which would be licensed in ensure legal compliance). • Works timed to avoid the seasons when bats are most likely to be present. • Bats would be excluded before felling. • Trees would be soft felled. • Works would be conducted under the supervision of a licenced bat ecologist. • Provision of lengths of tall and dense vegetation planting alongside the carriageway to elevate the flight path of bats over the height of heavy goods vehicles. • Sensitive design of new and extended culverts to maximise the diameter of these structures, providing safe routes under the road. • Provision of planting to guide bats to safe crossing points (hop-overs and culverts). 	Neutral & moderate adverse (permanent)

	Construction/ Operation	Mitigation	Residual effects
Lighting	Construction & operation	<ul style="list-style-type: none"> • Construction lighting would be directional and use the minimal brightness required. • Avoidance of lighting along the scheme (lighting is limited to junctions on the scheme only). • Lighting to be in accordance with <i>Bats and lighting in the UK, Bats and the Built Environment Series</i>. (BCT, 2009) and <i>Interim Advice Note 116/09: Nature Conservation Advice in Relation to Bats</i> (Highways Agency, 2008). • Planting would be provided in lit areas to shield adjacent habitats from lighting. • Close board fencing would temporarily be provided in areas adjacent to sensitive habitats as screening in lit areas until planting has matured. • Lighting in the vicinity of retained roosts would be directed to ensure roost exits are not lit. 	Neutral

Water vole

11.5.220 The presence of water vole was identified at two locations on the Alconbury Brook within the A1 Alconbury to Brampton Hut Section of the scheme with a potential latrine also located east of Girton in section 5 of the scheme (Cambridge Northern Bypass) (*Figure 11.11*). Activities associated with the scheme include the creation of outfalls and culverts, river re-alignment and bridging and working in proximity to water vole habitat. Works affecting Alconbury Brook specifically includes a short stretch of channel re-alignment. Potential impacts as a result of these activities include:

- habitat loss;
- direct killing or injury during construction;
- disturbance;
- severance; and
- changes in environmental conditions including;
 - changes in water quality; and
 - changes in flow conditions & dewatering.

11.5.221 Habitat loss: Habitat loss is a potential impact on water vole within the area. As a semi-aquatic mammal, whose burrows exist within the banks of watercourses, the greatest impact on this species relates to loss of water channels and their immediate surrounding terrestrial habitat. Where a waterbody is to be impacted, i.e. realigned or culverted, potential feeding areas and areas for burrows would be lost.

11.5.222 A dedicated water vole receptor site has been identified on the A1 Alconbury to Brampton Hut Section of the scheme within the design mitigation which would provide permanent suitable aquatic (standing water) and terrestrial habitat for this species (*Figure 11.13*). In addition, GCN receptor sites and general wildlife ponds (see *Figure 11.13*) should provide suitable habitat for this species. Habitat loss/gain figures (*Table 11.21*) show that a maximum of 0.7ha of running water habitat would be lost as part of the scheme with a potential gain of over 72ha of standing water habitat. Retained habitats within the scheme boundary would be managed to maximise their value for biodiversity. Water vole are herbivorous and eat grass and waterside vegetation. Certain plants have been identified as being preferential plant food for water vole diet and habitat enhancement would include these identified species. All of the planted species would be nursery grown, native species of local provenance. The use of woody plants would generally be avoided in areas created for water vole as water vole require dense growth of herbaceous bankside and emergent vegetation. Based on the mitigation to be provided, habitat loss is screened out as having a significant effect during both construction and operation.

- 11.5.223 Direct killing or injury during construction: Direct killing or injury of water vole can occur when works take place in proximity to river banks. Realignment of a watercourse where water voles have burrows could potentially cause injury or death when banks are reprofiled, watercourses realigned or culverts constructed. Key areas of concern exist in relation to the Alconbury Brook at the northern end of the scheme.
- 11.5.224 Pre-construction walkovers, to include appropriate sections of all culverted watercourses, would identify areas of watercourse where water vole continue to be present, have colonised or are likely absent. If water voles inhabit the area and burrows are present, relocation of the impacted population would be required and a water vole receptor site is identified within the scheme within the A1 Alconbury to Brampton Hut Section of the scheme. The receptor site would be developed for water vole in advance of any relocation to ensure habitats are ready to support water vole at the appropriate time. As detailed in *Appendix 11.11* mitigation licences to translocate water vole are obtained only for conservation purposes and thus a net improvement must be gained in the proposed receptor area.
- 11.5.225 Where there are to be no direct impacts on the watercourse a 5m working buffer would be implemented. Where water vole are known to be likely absent, and where works in proximity to watercourses are to occur, methods would be put in place to prevent the future colonisation of these areas during construction. This would be achieved by careful removal of surface vegetation within 5m of the watercourse.
- 11.5.226 Where water vole are present in the vicinity of proposed works, but have not excavated burrows, localised strimming of the development area would also be implemented to prevent water voles establishing new burrows. This technique is appropriate in small areas to be developed (e.g. short lengths of culverting) where suitable habitat exists within 50m of the scheme. The low density of water vole in the area indicate that issues of territory would not arise, but this would be fully assessed following pre-construction walkovers, prior to implementation of strimming.
- 11.5.227 In such areas of localised strimming during the growing season where there are no burrows, vegetative regrowth would be removed at frequent intervals during the construction phase to prevent colonisation. The design has minimised the lengths of culverts and thus this method which is most likely to be successful over short lengths of bank would be highly appropriate to prevent water voles entering an area of development during construction. Fencing would also be considered at the design stage to add an additional level of protection to this species.
- 11.5.228 Taking into account the mitigation described, direct killing or injury is screened out as a significant effect during construction.

- 11.5.229 Disturbance: Disturbance in terms of water vole ecology relates to an activity that does not directly affect water vole habitat i.e. there is no habitat loss, nor any activity that physically changes the water vole habitat. Such disturbance may, for example include light pollution from light sources during construction and noise from both construction and operation. Both noise and light are factors that could cause behavioural avoidance. Knowledge in relation to water vole tolerance to disturbance is conflicting. Some studies have shown that water vole are capable of tolerating quite high levels of disturbance, whereas other studies have found that in areas of noise, water vole would move to quieter locations within their territory. To avoid a negative impact on the water vole population if identified as present during pre-construction walkover surveys, disturbance would be avoided and where this is not practicable, working methods to reduce disturbance would be implemented. Works on features such as the clear span bridge at Ellington Brook, where no close bank work would occur but work in proximity to the bank would arise, have the potential to disturb water vole, through noise and lighting. Minimising lighting in such areas and the avoidance of extended periods of noisy plant usage would lower disturbance. Whilst water vole are predominantly active during the day, avoidance of overnight working would also reduce the disturbance impacts on water vole.
- 11.5.230 Where alternative habitat is available, contiguous with, and accessible to water vole habitat to be disturbed, and there is no expected direct impact on the water vole's habitat, then mitigation can be confined to assessing the availability of alternative habitat and provision of a good buffer zone from the works. An ideal minimum buffer zone would be 5m, but would be extended to 10m if practicable. Pre-construction walkovers would dictate whether suitable available habitat free from water vole exists contiguous with the zone of disturbance, in order to fully prescribe mitigation in a particular area. Given the implementation of the above mitigation measures, disturbance is screened out as having a significant effect.
- 11.5.231 Severance: Severance has the potential to impact upon the water vole population and their ability to explore and disperse. Water voles are faithful to their burrows and feeding areas but would, during certain times of the year, actively look to increase their range. The mitigation plan for the scheme includes methods to ensure that the offline sections do not cause severance of the known water vole habitat. Where the scheme crosses existing watercourses, suitably sized culverts to accommodate riparian mammals have been included. The incorporation of appropriate culverts, in conjunction with guiding planting and sensitive lighting designs would allow water vole to disperse and thus severance is screened out as having a significant effect. If the culverts are not appropriate, alternative pipes or tunnels would be provided. The locations of proposed culverts of suitable dimension in order to prevent severance are presented in *Figure 11.13*.

- 11.5.232 Changes in environmental conditions: Pollution is strongly considered to have contributed to the decline of the water vole in Great Britain. Studies indicate that water vole are probably affected by poor water quality, both directly through contamination of water bodies with pollutants and indirectly through eutrophication and the potential to alter the nutrient status of waters. The accumulation of nitrogen levels in water has been attributed to the build-up of algal blooms and subsequent loss of water vole food plants. An increase in soil particles and deposition of vehicle-sourced pollutants, where water vole are present, could also change vegetation communities as a result of dust deposition.
- 11.5.233 The close proximity of watercourses to soil storage areas, borrow pits, the construction footprint and areas to be landscaped where water vole are present has the potential to impact upon water quality. Design mitigation in addition to specific mitigation outlined in ES *Chapters 8 & 17*, would mitigate for any potential impacts arising from the creation of dust or surface water run-off during construction. In general, water quality is expected to improve in the area around Huntingdon at the northern end of the scheme where water vole have the greatest potential to be impacted by the scheme
- 11.5.234 Changes in flow conditions and dewatering have the potential to impact upon water vole habitat integrity and may cause species desertion of a previously inhabited area. Dewatering of existing channels for the purposes of realignment has the potential to disturb the territory of water vole for example dewatering for the purposes of realignment Alconbury Brook, West Brook and Swavesey Drain.
- 11.5.235 Increased discharge during wet weather could create flood conditions which would be detrimental to the water vole population, not only by flooding burrows but also creating a flow too fast for optimum water vole conditions.
- 11.5.236 Dewatering is an equivalent impact to habitat loss and appropriate action as previously described would be conducted. To minimise the impacts of increased / reduced flow conditions, appropriate drainage and retention, balancing ponds/swales for controlled discharge into watercourse would be implemented. In order to further achieve controlled flow in areas of culverting, CIRIA/Environment Agency culvert design best practice would include natural substrate in culvert beds to ensure no net gain in velocity.
- 11.5.237 Taking into account the mitigation proposed above, changes in environment conditions are screened out as having significant effects during both construction and operation.
- 11.5.238 *Table 11.30* provides a summary of the impact assessment for water vole. Following the implementation of scheme mitigation all effects are considered neutral or neutral/slight positive. Any slight positive effects (which would be permanent) would be as a result of re-alignment activities creating additional channel habitats for water burrows.

Table 11.30: Summary of assessment of potential impacts and mitigation for water vole

Potential impacts	Construction / Operation	Mitigation	Residual effects
Habitat loss (gain)	Construction & operation	<ul style="list-style-type: none"> Dedicated water vole receptor would provide permanent aquatic and terrestrial habitat. GCN receptor sites and general wildlife ponds should provide suitable habitat. Re-alignment activities may create additional channel habitats for water burrows. 	Neutral & neutral/slight positive (for habitat creation)
Changes in environmental conditions	Construction & operation	<ul style="list-style-type: none"> Implementation of design mitigation measures. Appropriate drainage and retention, balancing ponds/swales for controlled discharge into watercourse would be implemented. CIRIA/Environment Agency culvert design best practice would include natural substrate in culvert beds to ensure no net gain in velocity. 	Neutral
Disturbance	Construction	<ul style="list-style-type: none"> Minimise lighting and avoid extended periods of noisy plant usage in sensitive areas. Buffer zone of 5-10m from suitable water vole habitat 	Neutral
Severance	Operation	<ul style="list-style-type: none"> Incorporation of oversized culverts, in conjunction with guiding planting and sensitive lighting designs. 	Neutral
Direct mortality	Construction	<ul style="list-style-type: none"> Pre-construction walkovers, to include appropriate sections of all culverted watercourses. If water voles inhabit the area and burrows are present, relocation of the impacted population would be required. Water vole receptor site would be developed for water vole in advance of any relocation to ensure habitats are ready to support water vole at the appropriate time. Where water vole are present, but have not excavated burrows, exclusion techniques by localised strimming of the development area would be implemented. Where there are to be no direct impacts on the watercourse a 5m working buffer would be implemented. Methods would be put in place to prevent the future colonisation of uninhabited areas during construction. 	Neutral

Otter

11.5.239 Evidence of otter was recorded on the major tributaries within the area of the scheme including Alconbury Brook, Cock Brook and Ellington Brook (*Figure 11.11*) although no holts or couches were identified. Scheme activities include the creation of outfalls and culverts, realignment and bridging. These have the potential to impact upon otter via the following pathways:

- habitat loss;
- direct killing or injury during construction;
- disturbance;
- species mortality vehicle collisions;
- severance; and
- changes in environmental conditions including;
 - water quality; and
 - changes in flow conditions.

11.5.240 Habitat loss: Aquatic habitat is of paramount importance to an otter population and the loss of stretches of rivers and to a lesser extent drains, ditches and ephemeral channels, through realignment, incorporation of culverts and through the road and associated landscaping, could have a detrimental effect on the local otter population.

11.5.241 Appropriate habitat, including woodland and scrub would be incorporated along re-profiled, realigned and culverted rivers. Habitat would be created along fencing leading to culverts and underpasses to provide cover and funnel otter into the mitigation features.

11.5.242 Pre-construction surveys, to include the relevant sections of all watercourses would determine whether there are any holts that have been created in the intervening period between the current data collection and the construction of the scheme in the vicinity of the works that would be impacted. Works that could breach the legislation protecting otters would require a derogation licence from Natural England (*Appendix 11.11*). Implementation of the above mitigation would result in no significant effects on otter as a result of habitat loss.

11.5.243 Direct killing or injury during construction: Otters are highly secretive animals, largely nocturnal in habit and would avoid detection during the day. Damage to a holt (if present) has the potential to injure or kill an otter while in a place of shelter. Whilst otters would actively avoid sources of human interference they may leave their home watercourse to search for additional sources of food or to access an alternative watercourse.

- 11.5.244 Works that could breach the legislation protecting otters would require a derogation licence from Natural England (*Appendix 11.11*). Delivery of tool box talks during site personnel inductions would alert site personnel of the potential of encountering otters during construction in at risk areas and would therefore go some way to avoiding collision with site plant. Minimising work in sensitive areas, at night, when otters are active would also minimise the potential for direct killing and injury and direct killing and injuring during construction is not considered likely to have significant effects on local otter populations.
- 11.5.245 Disturbance leading to avoidance behaviour: Like water voles, disturbance in terms of otter ecology relates to an activity that does not directly affect otter habitat. Such disturbance may, for example include light pollution from-light sources during construction and noise from both construction, and operation. Both noise and light are factors that could cause behavioural avoidance. Unlike water vole, otter are known to be highly susceptible to human disturbance.
- 11.5.246 To avoid a negative impact on the otter population, disturbing activities would be avoided and where this is not practicable, working methods to reduce disturbance would be implemented. Working at night in sensitive areas would be avoided, where this is not practicable, minimising lighting in such areas and the avoidance of extended periods of noisy plant usage would lower disturbance. Given the above mitigation and the absence of any known holts and/or couches within the scheme area, disturbance is not considered likely to have a significant effect on local otter populations.
- 11.5.247 Species mortality vehicle collisions: Although aquatic habitats are important for otter, otters, unlike water vole would range away from rivers to cross dry land between watercourses to reach alternative foraging habitats, often using smaller streams and ditches and other cover. As previously described otters can range over large distances and would continue to try and use 'known routes'. This loyalty to a route increases the potential for road casualties, especially where the route is traversed by the scheme.
- 11.5.248 Otters are susceptible to road mortality, especially where the scheme crosses watercourses known to be used by otter for exploration and dispersal, in the newly proposed offline section of the scheme. Otter casualties are regularly recorded in the wider area. Dry underpasses for mammals, including otter, have been designed to cross features that would otherwise present a barrier and potential for vehicle collision (*Figure 11.13*). Installation of mammal ledges on proposed culverts has also been designed to allow continued passage of otter along watercourses to prevent incursion onto the road. Construction of dry underpasses and mammal ledges should ensure no significant effects on local otter populations as a result of road mortality.
- 11.5.249 Severance: Given their large territories, otters would continue to try and use 'known routes' if alternative options are not incorporated into a mitigation strategy.

- 11.5.250 To offset the severance of habitat due to construction of a major linear feature, mitigation in terms of large culverts and associated ledges for periods of high flow is incorporated into the design. Suitably sized culverts with ledges and dry underpasses are proposed across the area as presented in *Figure 11.13* and as a result no significant effects on local otter populations are anticipated as a result of severance.
- 11.5.251 Water quality: The impact on water quality and otter population health is less pronounced than for water vole. Past declines in population levels have been attributed to habitat loss, severance, mortality due traffic accidents and drowning. However water pollution is considered to potentially affect the resilience of the total population towards other stressors. In addition, a lowering in water quality may impact upon the availability of aquatic prey items, such as pollution intolerant salmonid fish.
- 11.5.252 Design mitigation in addition to specific mitigation outlined in ES *Chapters 8 & 17*, would mitigate for any potential impacts arising from the creation of dust or surface water run-off during construction. No significant effects on otter are anticipated as a result of changes in water quality.
- 11.5.253 Changes in flow conditions: Changes in flow conditions have the potential to impact upon otter habitat integrity, through undermining the river banks, reducing prey availability and may cause species desertion of a previously inhabited area. Increased discharge during wet weather could create flood conditions which would be detrimental to the otter population. Increased flow has been attributed to otter mortality through drowning.
- 11.5.254 To minimise the impacts of increased / reduced flow conditions, appropriate drainage and retention, balancing ponds/swales for controlled discharge into watercourse would be implemented. Control and maintenance of current water levels, would be achieved with the use of SuDS (*Chapter 17*). In order to further achieve controlled flow in areas of culverting, CIRIA/Environment Agency culvert design best practice would include natural substrate in culvert beds to ensure no net gain in velocity and that conditions are retained for an abundance of prey species. Ledges would be incorporated into the proposed culverts to allow otter to leave the channel should periods of high flow occur as otter pass through enclosed areas. If ledges are not appropriate, alternative pipe crossings would be provided. Given the design and best practice mitigation outlined above, no significant effects are anticipated on otter as a result of changes in flow conditions.
- 11.5.255 *Table 11.31* provides a summary of the impact assessment for otter. Following the implementation of scheme mitigation, based on current knowledge, all effects during both construction and operation are considered neutral.

Table 11.31: Summary of assessment of potential impacts and mitigation for otter

Potential impacts	Construction/ Operation	Mitigation	Residual effects
Habitat loss (gain)	Construction & operation	<ul style="list-style-type: none"> • Appropriate habitat, including woodland and scrub would be incorporated along re-profiled, realigned and culverted rivers. • Habitat would be created along fencing leading to culverts and underpasses to provide cover and funnel otter into the mitigation features. • Pre-construction surveys, to include the relevant sections of all watercourses. • Works that could breach the legislation protecting otters would require a derogation licence from Natural England. 	Neutral
Changes in environmental conditions	Construction & operation	<ul style="list-style-type: none"> • Implementation of design mitigation measures. • Appropriate drainage and retention, balancing ponds/swales for controlled discharge into watercourse would be implemented. • CIRIA/Environment Agency culvert design best practice would include natural substrate in culvert beds to ensure no net gain in velocity. 	Neutral
Disturbance	Construction	<ul style="list-style-type: none"> • Working at night in sensitive areas would be avoided, minimise lighting in sensitive areas and avoidance of extended periods of noisy plant usage. 	Neutral
Severance	Operation	<ul style="list-style-type: none"> • Incorporation of dry underpasses and mammal ledges. 	Neutral

Potential impacts	Construction/ Operation	Mitigation	Residual effects
Direct mortality	Construction & operation	<ul style="list-style-type: none"> • Pre-construction surveys, to include the relevant sections of all watercourses. • Works that could breach the legislation protecting otters would require a derogation licence from Natural England. • Delivery of tool box talks during site personnel inductions would alert site personnel of the potential of encountering otters during construction in at risk areas. • Minimising work in sensitive areas, at night, when otters are active. • Dry underpasses for mammals, including otter, to cross features that would otherwise present a barrier and potential for vehicle collision. • Installation of mammal ledges on proposed culverts to allow continued passage of otter along watercourses to prevent incursion onto the road. 	Neutral

11.6 Cumulative impacts

- 11.6.1 A number of plans and projects for which cumulative impacts could potentially occur in tandem with the scheme have been identified in *Chapter 18*. The majority of these plans and projects relate to housing and mixed use development and no major linear infrastructure schemes similar to the scheme considered here are identified. Two small wind farm projects (three and four turbine projects) are identified 1.5km and 4km to the west of the scheme.
- 11.6.2 In relation to ecology and nature conservation the main potential impacts from which cumulative effects may arise in association with this scheme are considered to be:
- habitat loss;
 - changes in environmental conditions; and
 - severance.
- 11.6.3 The majority of habitat loss incurred as a result of the scheme is arable land which is the dominant habitat in the area, and other relatively less common semi-natural habitats would see a gain as a result of the scheme. Wind farm projects do not result in the loss of significant areas of habitat as the footprint of these developments is generally small. It is assumed that land lost to large housing and mixed development schemes in the area is also likely to be predominantly arable land and given that large areas of arable land would remain, no significant cumulative effects are considered likely as a result of the loss of arable land. Given the gains in other habitats seen as a result of this schemes, no significant cumulative effects would be anticipated as a result of the loss other habitats and cumulative effects on habitats overall are considered neutral.
- 11.6.4 Changes in environmental conditions, including air quality and water quality, would be mitigated as part of the scheme design and no significant effects on ecological features have been identified. The biggest changes in environmental conditions as a result of this scheme are likely to be along the offline section of the scheme. The major potential plans and projects identified within 1km of the scheme, i.e. Cambridge Northern Fringe, Darwin Green and Huntingdon West, are in the north-western and south-eastern ends of the scheme nearest the online sections, reducing the potential for cumulative impacts particularly during the construction phase. During the operational stages of these plans and projects, air quality impacts are considered unlikely to be a key issue due to the nature of the developments i.e. housing and mixed use. It is considered therefore that where these plans and projects adhere to best practice guidelines in relation to potential impacts on air and water quality, no significant cumulative effects are likely and effects would be neutral.

- 11.6.5 The size and linear nature of this scheme makes severance a key potential impact and this is recognised in the scheme design with severance being mitigated for by the strategic placement of culverts and structural planting. The nature and location of the plans and projects identified within the cumulative assessment, suggest that north-south severance is unlikely to be key issue for these developments and given the maintenance of key wildlife corridors and crossing points as part of this scheme, no significant cumulative effects as a result of severance are anticipated with effects considered to be neutral.
- 11.6.6 All assessments relating to cumulative effects are only considered probable, and not certain, given the lack of knowledge surrounding the precise details and timing of potential plans and projects identified in the cumulative assessment.

11.7 Summary of residual effects

- 11.7.1 *Table 11.32* summarises the assessment of residual effects for each ecological feature of value, in light of the mitigation measures.
- 11.7.2 The scheme would lead to a net gain of 271ha of semi-natural habitat, comprising predominantly semi-natural grassland and mixed woodland, which would be of greater general biodiversity value than the arable habitat which it would replace. The restored semi-natural habitats would provide a connective corridor within the farmland landscape, linking adjacent habitats and enhancing the ability for wildlife to move through the landscape.
- 11.7.3 Permanent, slight positive effects are anticipated as a result of habitat creation for Brampton Meadow SSSI, aquatic and terrestrial invertebrates, fish, GCN, breeding birds and water vole with permanent moderate effects also anticipated for bats as a result of habitat creation.
- 11.7.4 Permanent, moderate adverse effects are predicted as a result of disturbance to County value breeding birds (grasshopper and Cetti's warblers) during the operational phase of the scheme. This assessment is considered highly precautionary and the worst case (i.e. effects may be neutral rather than adverse) given the lack of certainty over how birds would respond/habituate to traffic noise over time and how they would utilise habitats created as part of the scheme either permanently or otherwise. Likewise, due to the uncertainty over how bats respond to traffic noise and how they would utilise new habitats (permanently maintained or otherwise), permanent, moderate adverse effects are also considered probable for bats in respect of disturbance during operation.
- 11.7.5 It is also uncertain if mitigation actions would be effective enough to ensure any increase in mortality via vehicle collisions would not have significant effects on local bat populations. A highly precautionary approach to the assessment has therefore been applied and the residual effects on bats during operation due to increased risk of mortality are considered to be permanent, moderate adverse.

- 11.7.6 Overall therefore, the scheme would have neutral effects on bats and positive effects on most bird species, although there would remain a possibility that there would be moderate adverse effects on grasshopper and Cetti's warblers due to noise disturbance as these species are of a relatively high proportion of the County population and have restricted habitat availability in the vicinity of the scheme.
- 11.7.7 In line with guidance, the assessment has taken a worst case approach and has therefore not included the positive effects that would occur through the restoration of the borrow pits as there is no current commitment to the long term management of the restored habitats in these large areas. However, the restoration of these areas would provide short to medium term positive effects and there is a possibility that long term benefits would occur dependent on the eventual management of these areas. Were long term management of the restored borrow pits to be secured, the scheme would be likely to achieve slight to moderate positive effects for all species assessed.

Table 11.32: Summary of residual effects

Valued ecological receptor	Value	Residual effects	
		Construction	Operation
Portholme SAC/SSSI	International	Neutral	Neutral
Ouse Washes SAC/SPA/Ramsar/SSSI	International	Neutral	Neutral
Eversden and Wimpole Woods SAC/SSSI	International	Neutral	Neutral
Brampton Meadow SSSI	National	Neutral	Neutral/slight positive permanent (certain) for habitat creation
Brampton Wood SSSI	National	Neutral	No impacts
Brampton Racecourse SSSI	National	Neutral	Neutral
Madingley Wood SSSI	National	No impacts	No impacts
Little Paxton Pits SSSI	National	No impacts	No impacts
St Neots Common SSSI	National	No impacts	No impacts
Buckden Gravel Pits CWS	County	Neutral	Neutral
River Great Ouse CWS	County	Neutral	Neutral
Fenstanton Pits (West End Pits) CWS	County	Neutral	Neutral
Madingley Brick Pits CWS	County	Neutral	No impacts
Brampton Road A1 Slip Road CWS	County	Neutral	No impacts

Valued ecological receptor	Value	Residual effects	
		Construction	Operation
Hinchingbrooke Gravel Pits CWS	County	Neutral	Neutral
Brampton Flood Meadows CWS	County	Neutral	Neutral
West Meadow CWS	County	Neutral	Neutral
Habitats	Local	Slight adverse, temporary (certain) for habitat loss	Slight positive, permanent (certain) for habitat gain.
Aquatic invertebrates	Local	Neutral	Slight positive, permanent (probable) for habitat gain.
Terrestrial invertebrates	Local & County	Slight adverse, temporary (certain) for habitat loss	Slight positive, permanent (certain) for habitat gain.
Fish	Local	Neutral	Slight positive, permanent (probable) for habitat gain.
Great crested newt	Local	Neutral	Slight positive, permanent (certain) for habitat creation.
Breeding birds	County	Neutral	Slight positive, permanent (certain) for habitat creation. Moderate adverse, permanent (probable) for disturbance.
Barn owl	County	Neutral	Neutral
Wintering birds	County	Neutral	Neutral
Bats	Local-County	Moderate adverse, temporary (certain) for habitat loss	Moderate adverse, permanent (probable) for disturbance and mortality. Moderate beneficial, permanent (probable) for habitat gain.
Otter	Local	Neutral	Neutral
Water vole	Local	Neutral	Slight positive, permanent (probable) for habitat creation.

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