

# A47/A11 Thickthorn Junction

**Scheme Number: TR010037**

## **Volume 6**

### **6.1 Environmental Statement**

#### **Chapter 8 - Biodiversity**

APFP Regulation 5(2)(a)

Planning Act 2008

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Infrastructure Planning

Planning Act 2008

**The Infrastructure Planning  
(Applications: Prescribed Forms and  
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The A47/A11 Thickthorn Junction  
Development Consent Order 202[x]

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**CHAPTER 8  
BIODIVERSITY**

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## 8. Biodiversity

### 8.1. Introduction

- 8.1.1. Highways England (the Applicant) has submitted an application for an order to grant a development consent order (DCO) for the A47/A11 Thickthorn Junction (hereafter referred to as ‘the Proposed Scheme’). The Proposed Scheme will create one new connector road between the A11 and A47 and provide a new link road between Cantley Lane South and the B1172 Norwich Road for continued access to the Thickthorn Junction. Two new underpasses and two new overbridges will also be constructed along with improvements to the Thickthorn roundabout. The Proposed Scheme will reroute traffic away from the existing Thickthorn Junction, which currently experiences delays and high levels of congestion during peak hours.
- 8.1.2. Under the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, the Proposed Scheme is an Environmental Impact Assessment (EIA) development and as such requires submission of an Environmental Statement presenting the likely significant environmental effects of the Proposed Scheme.
- 8.1.3. As part of the EIA process, this Environmental Statement (ES) chapter reports the potential significant effects for Biodiversity as a result of the Proposed Scheme. This assessment includes a review of the existing baseline conditions, consideration of the potential impacts, identification of proportionate mitigation and enhancement, monitoring and residual effects.
- 8.1.4. The approach to this assessment follows methods set out in the EIA Scoping Report which was issued to the Planning Inspectorate (PINS) in February 2018 (**TR010037/APP/6.5**) and subsequent Scoping Opinion received (March 2018) (**TR010037/APP/6.6**) for the Proposed Scheme, in combination with the most up to date guidance documents and the standards set out in the Design Manual for Roads and Bridges (DMRB) LA 118 Biodiversity and LD108 Biodiversity design.
- 8.1.5. Legislation, standards, best practice guidelines and national and regional policy relevant to this assessment are listed in Appendix 8.13 (**TR010037/APP/6.3**).

### 8.2. Competent expert evidence

- 8.2.1. The ecological competent expert for this assessment has over 19 years’ experience in UK ecological and environmental consultancy, as well as experience of planning and conducting ecological survey work overseas. They hold a BSc (Hons) in Zoology and MSc in Environmental Science. They are an active member of the Chartered Institute of Ecology and Environmental

Management (CIEEM), sit on their Professional Standards Committee as well as being a Chartered Environmentalist (CEnv) and a Chartered Biologist (CBiol). They have conducted and produced a wide variety of ecological surveys and reports, and they have designed, implemented and managed mitigation projects for bats, badgers, otters, reptiles and great crested newts (GCN). They have used their EIA knowledge and professional judgement in identifying the likely significant impacts associated with the Proposed Scheme and providing technical guidance through the assessment process.

### 8.3. Legislation and policy framework

8.3.1. In preparation of this chapter, the following key legislation and policy documentation has been used. For full details of the relevant legislative scope of each document, please see Appendices 8.1 to 8.13 **(TR010037/APP/6.3)**.

- National Policy Statement for National Networks (2014) (Section 5.20)
- National Planning Policy Framework (2019) (Section 15)
  - Statement 9 (PPS9): Biodiversity and Geological Conservation (2005) (withdrawn)
  - ODPM 06/2005: Biodiversity and Geological Conservation – Statutory Obligations and their impact within the Planning system.
- Planning Policy (Regional) - The East of England Plan (2008)
  - POLICY ENV1: Green Infrastructure
  - Policy ENV3: Biodiversity and Earth Heritage
- South Norfolk District Council Local Plan (2015-2026)
  - Policy DM 1.4 Environmental quality and local distinctiveness
  - Policy DM 3.8 Design principles applying to all development
  - Policy DM 4.2 Sustainable drainage and water management
  - Policy DM 4.4 Natural environmental assets – designated and locally important open space
- Norfolk Biodiversity Action Plan (BAP)
- Key Legislation (International/European)
  - The Habitats Directive (Council Directive 92/43/EEC1992)
  - The Birds Directive (Council Directive 2009/147/EC2009)
- Key Legislation (National)
  - Conservation of Habitats and Species Regulations 2017 (as amended)
  - The Wildlife & Countryside Act 1981 (as amended) (WCA)
  - The Countryside and Rights of Way (CRoW) Act 2000

- The Protection of Badgers Act 1992
- Hedgerows Regulations 1997
- The Natural Environment and Rural Communities Act 2006 (NERC)
- Highways England Biodiversity Action Plan (HEBAP) 2015

## 8.4. Assessment methodology

8.4.1. The assessment of impacts on biodiversity follows the most recent Highways England standards, the Design Manual for Roads and Bridges (DMRB):

- Ecological survey and design measures – DMRB, LD 118 Biodiversity Design
- Assessing and reporting the effects of highway projects on biodiversity – DMRB, LA 108 Biodiversity
- Assessment and reporting of the implications on European sites – DMRB, LA 115 Habitats Regulations assessment

8.4.2. The assessment has also been undertaken in reference to CIEEM's Ecological Impact Assessment (EclA) guidance (2018).

8.4.3. The following key stages are involved in the assessment:

- Identification and description of the baseline ecological conditions at the site and likely ecological constraints (Section 8.7)
- Valuation of each individual ecological receptor in respect of geographical scale as described in Section 8.7 of this chapter
- The zone of influence of the project and which important biodiversity resources could be significantly affected (Section 8.6)
- Identification and characterisation of development activities that may affect ecological receptors (Section 8.8)
- Identification of mitigation measures and enhancement opportunities to avoid or reduce the effects, as well as compensation measures where effects cannot be avoided (Section 8.9)
- Identification of enhancement opportunities that will support environmental net gain (Section 8.9)
- Evaluation of the significance of residual effects (nature and scale) (Section 8.10)

8.4.4. Ecological receptors are valued based upon their importance at a geographical scale as detailed in Table 1-1 of ES Appendix 8.12 (**TR010037/APP/6.3**) (taken from DMRB LA 108 Biodiversity Table 3.9). Receptors valued at lower than local value were defined as having negligible value. Only ecological receptors of value (local value or higher), or those which have legal constraints (for example,

badger and Invasive Non-native Species (INNS)) were taken forward in the impact assessment process.

- 8.4.5. Impacts are defined as the changes resulting from an action, and effects are defined as the consequences of these impacts.
- 8.4.6. The level of impact upon ecological receptors is assessed in reference to the standards of DMRB LA 108 Biodiversity Table 3.11, which is detailed in Table 1-2 of Appendix 8.12. Activities that are not considered to have any observable impacts (either positive or negative) upon some ecological receptors were not taken forward in the impact assessment process. The predicted impacts for the Proposed Scheme are presented in Section 8.8, Table 8-7 and 8-8 prior to the consideration of mitigation.
- 8.4.7. Professional judgement has been used to predict the level of the impact upon each receptor in accordance with DMRB standards set out in LA 108 Biodiversity.
- 8.4.8. Potential impacts on biodiversity resources are divided into two categories:
- Construction activity impacts: includes those impacts which arise as a result of construction activities which also include the permanent effects (such as habitat loss).
  - Operation impacts: includes those impacts which arise as a result of activities during use of the Proposed Scheme (such as bird mortality through traffic collisions).
- 8.4.9. Activities during construction and operation of the Proposed Scheme have the potential to result in impacts on ecological features. The level of impact of these activities on the ecological features that have been carried through to assessment are characterised taking account of the following parameters:
- Positive (beneficial) or negative (adverse): a positive impact is a change that improves the quality of the environment or impacts that may halt or slow an existing decline in quality of the environment. A negative impact is a change which reduces the quality of the environment.
  - Duration: the duration of an impact (permanent or temporary) is determined in relation to the ecological feature's characteristics and lifecycle.
  - Reversibility: an impact is considered to be irreversible (permanent) if it is *“one from which recovery is not possible within a reasonable timescale or for which there is no reasonable chance of action being taken to reverse it”*. An impact is considered reversible (temporary) where *“Spontaneous recovery is possible, or which may be counteracted by mitigation”* (CIEEM, 2018).



- Extent: this is defined as the geographical area over which the impact will occur. In relation to sites and habitats, the extent and magnitude will be the same.
- Magnitude: magnitude refers to the 'size' of the impact such as the total area of habitat (extent) or in terms of species, the number of individuals impacted. The description of an impact's magnitude is quantitative where possible.
- Timing and frequency: the number of times an activity occurs which will influence the resulting impacts and the timing of an impact upon the ecological feature's life-stages or seasonal behaviour.

- 8.4.10. Measures to avoid or reduce the impact on ecological resources have been considered throughout the development of the Proposed Scheme as part of an iterative process. Mitigation measures have been developed to reduce impacts during both the construction and operation phases as detailed within this chapter.
- 8.4.11. In accordance with CIEEM guidance, mitigation and design interventions for the Proposed Scheme are detailed in Section 8.9.
- 8.4.12. Cumulative impacts of multiple threats or pressures can make habitats and species more sensitive to effects. The cumulative effects of the Proposed Scheme have been considered in combination with all other developments within a potential Zone of Influence (ZOI) including developments currently in planning, consented, being built, completed or operational.
- 8.4.13. No in-combination effects have been anticipated with the other A47 corridor improvement schemes due to the distance involved between Thickthorn Junction and the other schemes which are located between 10 km north west (North Tuddenham to Easton), 16 km east (Blofield) and 80 km west (Guyhirn), of the site. These have been scoped out from further assessment.
- 8.4.14. The cumulative residual effects of ES chapters 6 to 14 have been considered on each receptor and reported in ES Chapter 15 (Combined and Cumulative Effects) (**TR010037/APP/6.1**). Cumulative impacts of multiple threats or pressures can make habitats and species more sensitive to effects. The cumulative effects of the Proposed Scheme have been considered in combination with all other developments within a potential Zone of Influence (ZOI) including developments currently in planning, consented, being built, completed or operational.
- 8.4.15. Biodiversity gains and losses have been assessed by using the Defra metric 2.0, which has informed the proposed mitigation measures to minimise the effects of the Proposed Scheme.

## Consultation

8.4.16. Consultation was undertaken in February 2020 with the following consultees:

- Natural England
- Environment Agency
- RSPB
- Norfolk Wildlife Trust (NWT)
- Norfolk County Council (NCC)
- Norfolk Badger Trust (NBT)

8.4.17. Consultation was undertaken with Natural England and the Environment Agency to consider the potential to achieve biodiversity net gain. They advised that the fragmented landscape presents an opportunity for biodiversity net gain and to mitigate habitat severance.

8.4.18. As a result of this consultation, NWT were contacted regarding the information and species data for the Roadside Nature Reserves (RNR) road verge habitat. A response was received in the same month stating that records must be sought from Norfolk Biodiversity Information Service (NBIS). Records have been obtained from NBIS.

8.4.19. A bat survey data exchange between A47 Schemes and the proposed Norwich Western Link (NWL) road was recommended in a meeting with NCC and Natural England held in February 2020.

8.4.20. NCC have been consulted regarding barbastelle bats *Barbastella barbastellus* and the wider mitigation proposals for bats for the Proposed Scheme. In addition, bat mitigation implemented as part of the completed A1270 Broadland Northway and the associated monitoring data was discussed. Data was exchanged on the locations of barbastelle bats.

8.4.21. The Environment Agency have additionally been consulted with regard to the realignment of Cantley Stream and is reported in detail in ES Chapter 13: Road Drainage and Water Environment (**TR010037/APP/6.1**).

8.4.22. Consultation with Norfolk Badger Trust provided information on at least eight badger road kills near to this Scheme and information was provided relating to one known sett which in recent examination by NBT was not very active.

## Assessment criteria

- 8.4.23. The relative biodiversity resource importance has been considered within the geographical framework set out in DMRB LA 108 standards, table 3.9 (see Table 1-1 of appendix 8.12) **(TR010037/APP/6.3)**:
- International or European
  - National (UK)
  - Regional (East of England)
  - County (South Norfolk)
  - Local (Scheme and vicinity).
- 8.4.24. Reference to DMRB standards LA 108 Biodiversity is used to determine the level of importance of a resource, and whether the resource is at a level of importance which should be carried through the assessment stage.
- 8.4.25. DMRB standards LA 108 Biodiversity states that the importance of designated sites depends on the geographical level to which they are protected. The importance of habitats depends on whether they are listed as priorities for conservation action (such as in the UKBAP or LBAP); their relative naturalness, rarity, size, level of connectedness with other habitats and whether they are threatened by the impacts from Proposed Scheme at a given geographic scale. Included are areas of habitat which meet the definition for designated habitats, but which are not themselves designated (see ES Appendix 8.12 **(TR010037/APP/6.3)** for full tables from LA 108 Biodiversity).
- 8.4.26. For species, the importance is determined according to their level of protection (all species which are protected under European or national legislation are important from an EclA perspective) and also their relative rarity (for example inclusion in red data lists<sup>1</sup>), population size, how easily they spread or disperse and whether they are threatened. Included are species at a critical stage of their life cycle and populations of species that form critical parts of the wider population. The category levels of importance are the same as for habitats.
- 8.4.27. Legally controlled species (that is, Invasive Non-native Species (INNS)) listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended) are considered important species because of the legal requirements to control or manage them.

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<sup>1</sup> Those listed within the IUCN Red Data List and Red Data Book of British Invertebrates (Bratton 1991)

- 8.4.28. Badgers are considered because of the legal requirements of The Protection of Badgers Act, 1992 (ES Appendix 8.13 **(TR010037/APP/6.3)** contains details of the Act).
- 8.4.29. The level of impact is considered in line with in DMRB LA 108 standards, which is described in detail in Table A1-2 of ES Appendix 8.12 **(TR010037/APP/6.3)**. Professional judgement will be used to categorise the level of impact of each activity as being ‘major’, ‘moderate’, ‘minor’, ‘negligible’ or ‘no change’ and ‘adverse’ or ‘beneficial’.
- 8.4.30. To summarise, activities during construction and operation of the Proposed Scheme have the potential to result in impacts on ecological features. The level of impact of these activities on the ecological features that have been carried through to assessment are characterised taking account of the following parameters:
- Positive (beneficial) or negative (adverse)
  - Duration: the duration of an impact (permanent or temporary)
  - Reversibility
  - Extent /or magnitude
  - Timing and frequency
- 8.4.31. Magnitude of impact refers to size, amount, intensity and volume, as per the CIEEM guidance for EclA (2018).
- 8.4.32. The term ‘level of impact’ has been used in place of ‘magnitude’ for the purposes of this ES chapter, as stated in the DMRB standards in LA 108 Biodiversity.
- 8.4.33. The importance of the ecological resource and the level of impact has been used to determine the significance of effects taking account of the matrix in Table 8-1, in combination with professional judgement. The effects that are categorised as ‘moderate’ or above are considered significant.

Table 8-1 Significance of effects matrix (LA108 Table 3.13)

Resource Importance	Level of Impact				
	No Change	Negligible	Minor	Moderate	Major
<b>International</b>	Neutral	Slight	Moderate or Large	Large of Very Large	Very Large
<b>National</b>	Neutral	Slight	Slight or Moderate	Moderate of Large	Large of Very Large

Resource Importance	Level of Impact				
	No Change	Negligible	Minor	Moderate	Major
<b>Regional (East of England)</b>	Neutral	Neutral or Slight	Slight	Moderate	Moderate or Large
<b>County (Norfolk)</b>	Neutral	Neutral or Slight	Neutral or Slight	Slight	Slight or Moderate
<b>Local (Scheme and vicinity)</b>	Neutral	Neutral	Neutral or Slight	Neutral or Slight	Slight

- 8.4.34. Mitigation was deemed as being required where one or both of two criteria were met:
- i. the biodiversity resource is offered legal protection and a mandatory obligation is imposed to provide measures to ensure that an offence would not be committed
  - ii. where impacts have been identified in the assessment process. Mitigation is proposed (where practicable) at the relevant scale of significance, using the following hierarchy: Avoidance, Mitigation, Compensation, Enhancement.
- 8.4.35. Residual effects take into consideration committed mitigation and design interventions, and these are assessed and detailed in Table 8-12.

## 8.5. Assessment assumptions and limitations

- 8.5.1. Specific limitations relevant to each survey, such as access constraints, are detailed in the relevant ecology survey results contained within ES Appendices 8.1 to 8.11 (**TR010037/APP/6.3**). It is not considered that any of these survey specific constraints represent a significant limitation, barrier or data gap to the collation of a robust baseline .
- 8.5.2. It should be noted that the absence of protected species records from the desk study, as part of the EclA, and observations of the same during the surveys undertaken does not preclude their presence within the study area (or on-site). There is always the risk of protected species being overlooked either owing to the timing of the survey, the scarcity of the species on site and limitations to survey methodologies.
- 8.5.3. Ecological surveys still to be completed in 2021 include:
- Between mid-April and the end of June 2021, the eDNA surveys of ponds that could not be accessed in 2020 (due to Covid-19 and access restrictions) are to be undertaken to establish great crested newt presence or absence.

The assessment was done on a precautionary basis therefore, the absence of this is not considered a limitation to the impact assessment.

## 8.6. Study area

8.6.1. The distance over which the Proposed Scheme could affect protected habitats and species can vary, due to the variability between ecological receptors. The zone of influence (ZOI) includes the DCO boundary shown on ES Figure 8.1 Proposed Scheme (**TR010037/APP/6.2**), and the additional appropriate species-specific areas used for ecological surveys as set out in ES Appendices 8.1 to 8.11 (**TR010037/APP/6.3**). Table 8-2 below details the study areas for each considered ecological receptor.

Table 8-2 Zone of influence for specific ecological receptors

Ecological receptor	Zone of influence from the proposed scheme
International and nationally designated sites (including Special Areas of Conservation (SACs), possible SACs (pSAC), Special Protection Areas (SPAs), potential SPAs (pSPA), Wetlands of International Importance (Ramsar Sites), National Nature Reserves (NNRs) and Sites of Special Scientific Interest (SSSIs)	2km unless connected via a green corridor or hydrologically
SAC designated for bats	30km
Locally designated conservation sites (including Local Nature Reserves (LNRs), Local Wildlife Sites (LWSs and CWSs) and RSPB reserves)	2km
Phase 1 habitat survey	All accessible land within the DCO boundary of the Proposed Scheme, plus a 100m buffer
Botanical survey	All accessible land within the DCO boundary of the Proposed Scheme
Terrestrial invertebrate	Targeted areas within the DCO boundary of the Proposed Scheme
Aquatic invertebrate	Targeted areas within the DCO boundary of the Proposed Scheme and 50m buffer
Great crested newt (GCN)	All waterbodies within 500m of the DCO boundary of the Proposed Scheme
Reptile	All accessible land within the DCO boundary of the Proposed Scheme, plus a 50m buffer
Breeding bird	All accessible land within the DCO boundary of the Proposed Scheme, plus a 500m buffer

Ecological receptor	Zone of influence from the proposed scheme
Wintering bird	All accessible land within the DCO boundary of the Proposed Scheme, plus a 500m buffer
Bat	All accessible trees and buildings within 50m of the proposed works with potential to support roosting bats.
Otter	All accessible, suitable habitat within the DCO boundary of the Proposed Scheme, plus a 250m buffer. Spot checks of bridges 3km buffer.
Water vole	All accessible, suitable habitat within the DCO boundary of the Proposed Scheme, plus a 250m buffer
Polecat	All accessible, suitable habitat within the DCO boundary of the Proposed Scheme, plus a 50m buffer
Badger	All accessible land within the DCO boundary of the Proposed Scheme, plus a 50m buffer
Invasive species	All accessible, suitable habitat within those areas surveyed above

## 8.7. Baseline conditions

- 8.7.1. The baseline ecological condition of the receptors listed in Table 8-2 within the Proposed Scheme ZOI was determined using established standard methodologies as detailed in full within the appendices for each species (ES Appendices 8.1 to 8.11) **(TR010037/APP/6.3)**.
- 8.7.2. A list of surveys undertaken to date, including the dates of survey and good practice guidelines employed, is provided in Table 8-3 below.

Table 8-3 Surveys undertaken

Survey	Dates undertaken	Guidance and methodologies
Phase 1 habitat survey and preliminary ecological appraisal (PEA)	September 2016 Update desktop study and habitats recorded during Phase 2 surveys in 2017 Habitat updates recorded during Phase 2 surveys in 2019	JNCC's Handbook for Phase 1 habitat survey - a technique for environmental audit (JNCC, 2016) CIEEM's Guidelines for Preliminary Ecological Appraisal (CIEEM, 2017)
Botanical survey	June 2017	List of species using dominance (DAFOR) scale



Survey	Dates undertaken	Guidance and methodologies
	June and July 2020	
Terrestrial invertebrates	April to August 2017 May to August 2020	Drake et al., (2007) By visual identification
Aquatic invertebrates	March and September 2017 June to August 2020	Drake et al., (2007)
GCN	Habitat Suitability Index (HSI) assessments in May 2016. Environmental DNA surveys in April 2017 HSI assessments and eDNA surveys updated in March and June 2020	Biggs et al., (2014) English Nature (2001)
Reptile	April 2017 to September 2017 July to September 2020	Gent and Gibson (2003) Use of refugia to attract reptiles on site, manual searches of suitable refugia present on site, checks for signs of reptile activity including sloughed skins, burrows, egg laying sites etc.; and sustained visual observation of banks and other suitable habitat within the site.
Breeding bird	April – June 2017 March – June 2020	Bibby et al., (2000) Gilbert et al., (1998) Birds were recorded by walking, listening and scanning by eye and with binoculars Birds were considered to be breeding if singing, displaying, carrying nest material, nests or young found, repetitively alarmed adults, disturbance displaying, carrying food or in territorial dispute
Wintering bird	January – March 2017 December 2017 and February 2018 January, February, November and December 2019	Bibby et al., (2000) Gilbert et al., (1998) As above, Birds were recorded by walking, listening, and scanning by eye and with binoculars All birds were recorded, regardless of the activity/behaviour
Hobby survey	July to September 2017 May to September 2020	Hardey et al. (2009)
Barn owl survey	September 2020	Shawyer (2011)
Bat roost appraisals	June and July 2016 April and May 2017 July 2020	Collins, J. (ed.) (2016). Bat Surveys for Professional Ecologists: Good Practice Guidelines, 3rd edition, Bat Conservation Trust.



Survey	Dates undertaken	Guidance and methodologies
Bat emergence and re-entry surveys	July to September 2017 July and September 2018 July to September 2020	Emergence and re-Entry surveys for high roost potential took place three times, for moderate two times, and for low once, in the period described
Bat activity transect surveys	April to October 2017	
Bat crossing point survey	July and August 2020	Berthinussen, A. & Altringham, J. (2015).
Otter	April and September 2017 July and September 2018 May and October 2020	Standard otter survey methodology as identified in the Environment Agency's Fifth Otter Survey of England 2009-2010 (Environment Agency, 2010), Monitoring the Otter (Chanin, 2003) New Rivers and Wildlife Handbook (Holmes <i>et al.</i> 2001) River and Wildlife Handbook (RSPB, NRA & RSN, 1994) Surveys involved searching for spraints, footprints, feeding remains, slides and haul-outs, couches and holts
Water vole	April and September 2017 July and September 2018 May and October 2020	Standard water vole survey methodologies of Strachan <i>et al.</i> , (2011) and Dean <i>et al.</i> , (2016), searching for field signs including latrine sites, feeding stations, lawns, prints and runways
Polecat	August to September 2017 January to March 2018 February – June 2020	Standard polecat survey methodology using camera traps in targeted locations. In addition, the use of baited footprint tunnels has also been used
Badger	January and March 2017 October 2019	Standard methodology [Harris <i>et al.</i> , (1989)] Search for all field signs within the study area. Field signs include setts and other excavations, latrines, prints and paths, hairs, feeding evidence
Invasive	No specific survey - invasive species have been identified north of the study area during the PEA (2017) and within the study area as an incidental sighting during Phase 2 surveys	By visual identification

## Designated sites

8.7.3. There are four statutory designated sites within 2km of the Proposed Scheme and three additional statutory sites further than 2km but hydrologically connected to the Proposed Scheme. Details in Table 8-4 below.

Table 8-4 Designated sites

Designated Site	Approximate distance from construction boundary at closest point (m) and direction	Description and reason for designation
The Broads SAC	11.5km east of the Proposed Scheme but hydrologically linked (downstream)	<p>The Broads contain several examples of naturally nutrient-rich lakes. Although artificial, having been created by peat digging in medieval times, these lakes and the ditches in areas of fen and drained marshlands support relict vegetation of the original Fenland flora, and collectively this site contains one of the richest assemblages of rare and local aquatic species in the UK.</p>
Broadland SPA	11.5km east of the Proposed Scheme but hydrologically linked	<p>The Broads are a series of flooded medieval peat cuttings and they lie within the floodplains of five principal river systems, known as Broadland.</p> <p>The site is designated for wintering populations of ruff <i>Philomachus pugnax</i>, hen harrier <i>Circus cyaneus</i>, eurasian wigeon <i>Mareca Penelope</i>, northern shoveler <i>Anas clypeata</i>, gadwall <i>Anas strepera</i>, Bewick's swan <i>Cygnus columbianus bewickii</i> and whooper swan <i>Cygnus cygnus</i></p> <p>The site is designated for breeding population of Bittern, <i>Botaurus stellaris</i> and Marsh Harrier <i>Circus aeruginosus</i></p>
Broadland Ramsar	11.5km east of the Proposed Scheme but hydrologically linked	<p>The site qualifies under Ramsar criterion 2 whereby it supports a number of rare species and habitats including the following Annex I features:</p> <ul style="list-style-type: none"> <li>• Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i></li> <li>• Alkaline fens</li> <li>• Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i>.</li> <li>• Desmoulin's whorl snail <i>Vertigo moulinsiana</i></li> <li>• Otter <i>Lutra lutra</i></li> <li>• Fen orchid <i>Liparis loeselii</i>.</li> </ul> <p>It also qualifies under Ramsar criterion 6 – species and populations occurring at levels of international importance. Species with peak counts in winter include:</p> <ul style="list-style-type: none"> <li>• Bewick's swan</li> <li>• Eurasian wigeon</li> <li>• Gadwall</li> <li>• Northern shoveler</li> </ul>
Eaton Chalk Pit SSSI	1.5km to the east	<p>This site consists of a series of abandoned chalk mines. The undisturbed tunnels are now used by various species of bat which hibernate underground during the winter months.</p> <p>The tunnels are used principally by Daubenton's bat <i>Myotis daubentoni</i>, Natterer's bat <i>M. nattereri</i> and brown long-eared bat <i>Plecotus auritus</i>. Up to 40 bats use the site with peak numbers occurring in January.</p>

Designated Site	Approximate distance from construction boundary at closest point (m) and direction	Description and reason for designation
Eaton Common LNR	1.4km to the east	<p>Lying adjacent to the River Yare this 6.2ha site largely comprises neutral grassland, which is marshy in places.</p> <p>Many of the former ditches are now just shallow depressions. There are smaller areas of tall herb and some broadleaved woodland.</p> <p>The area is grazed in the summer and when cattle are not available it is mown. The woodland is generally left unmanaged.</p> <p>Species of interest consist of marsh flora and otters.</p>
Earlham Park Woods LNR	1.9km to the north	<p>The site is situated on the edge of Earlham Park and includes a diverse range of habitat types including dense tall marsh, unimproved neutral grassland and woodland.</p> <p>There is also a pond which had silted up but some of which has been dredged creating open water.</p> <p>Species of interest consist of regenerating elm trees throughout woodland and a range of woodland flora</p>
Marston Marshes LNR	1.6km to the east	<p>This site (26 ha) comprises floodplain grazing marsh on the northern side of the River Yare. There are numerous dykes throughout the site, which are managed on a rotational basis. The grass is managed through summer grazing by cattle and mowing.</p> <p>Also included in the site are some small areas of damp woodland. Willows on site are managed through pollarding. There are five wildlife ponds.</p> <p>Species of interest include water voles, otters, orchids, as well as general good marsh flora and dragonflies. In the winter, geese use site in winter and snipe <i>Gallinago gallinago</i></p>

- 8.7.4. There are no SACs designated for bats within 30km of the Proposed Scheme. The Broads SAC and Broadland SPA and Ramsar sites have been assessed as a biodiversity resource of **international importance**.
- 8.7.5. Eaton Chalk Pit SSSI has been assessed as a biodiversity resource of **national importance** and Eaton Common, Earlham Park Wood and Marston Marshes LNRs a biodiversity resource of **local importance**.
- 8.7.6. In addition to the statutory sites detailed above, the desk study also identified 19 non-statutory designated County Wildlife Sites (CWSs) within 2km of the Proposed Scheme detailed in table 8-5 below.

Table 8-5 Non-statutory designated sites

Designated Site	Approximate distance from construction boundary at closest point (m) and direction
Meadow Farm Meadow CWS	Adjacent to the scheme

Designated Site	Approximate distance from construction boundary at closest point (m) and direction
Intwood Carr CWS	400m to the east
Foxburrow Meadow CWS	1.4km to the south
Softley Drive Meadow CWS	1.4km to the north east
Riding School Meadow CWS	1.2km to the east
Eaton Island CWS	1.3km to the east
Eaton Street Meadow CWS	1.5km to the east
Bluebell Marsh CWS	1.2km to the north east
Eaton Common CWS	1.9km to the east
Eaton Chalk Pit CWS	2km to the east
UEA Marsh CWS	1.6km to the north
UEA Butterfly Meadow CWS	1.6 km to the north
UEA Broad CWS	1.6km to the north
Braymeadow CWS	1.5km to the north west
Ketteringham Hall Lake CWS	1.4km to the south west

8.7.7. All the 15 CWS have been assessed as biodiversity resources of **county importance**.

### Priority habitats

8.7.8. The desk study indicated that ten NERC Act (2006) priority habitats are present within the 2km study area: lowland fens, traditional orchards, rivers, hedgerows, coastal and floodplain grazing marsh, standing water (ponds), arable field margins, lowland mixed and deciduous woodland, wood pasture and parkland and lowland meadows. These habitats have been assessed as biodiversity resources of **national importance**.

8.7.9. Norfolk BAP Priority Habitats present include cereal field margin, hedgerows, lowland wood pasture and parkland, mixed deciduous woodland. These habitats have been assessed as biodiversity resources of **county importance**.

## Extended Phase 1 habitat survey (2016-2019)

8.7.10. A baseline report in the form of an Environmental Assessment Report (EAR) was produced in 2016 for the Stage 2 Options Assessment. It includes the desk study and Phase 1 habitat survey information. This was updated in 2017 and subsequently in 2019 during phase two survey to provide an update to the existing information and additional surveys following the Scoping Opinion.

8.7.11. Habitats identified within the study area including a 100m buffer during the Extended Phase 1 Habitat survey and subsequent updates were<sup>2</sup>:

- Woodland
  - Broadleaved semi-natural
  - Broadleaved plantation
  - Coniferous plantation
  - Mixed plantation
  - Scattered trees/parkland
- Scrub
  - Dense or continuous
  - Scattered
- Parkland or scattered trees
- Grassland
  - Neutral semi-improved
  - Poor semi-improved
  - Improved
  - Marsh or marshy
- Tall ruderal
- Swamp
- Standing water
- Standing water (eutrophic)
- Running water
- Boundaries
  - Species poor intact hedge
  - Species poor defunct hedge
  - Native species rich hedge with trees

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<sup>2</sup> Listed as per headings and descriptions in the JNCC (2016), Handbook for Phase 1 habitat survey A technique for environmental audit.

- Species poor hedge with trees
  - Dry ditch
  - Fence
  - Arable
  - Amenity grassland
  - Bare ground (hard standing)
  - Buildings
- 8.7.12. Semi-improved, amenity and improved grassland, tall ruderal, buildings, bare ground and dense and scattered scrub have been assessed as a biodiversity resource importance at a **negligible importance level** due to being in isolated patches and of poor species diversity.
- 8.7.13. All hedgerows and hedgerows with trees, mixed and deciduous broadleaved woodland, wood pasture and parkland, arable field margin and standing water are listed as a priority habitat under Section 41 NERC Act 2006 and have been assessed as a biodiversity resources of value at a **national importance level**.
- 8.7.14. Scattered mature trees, some (four within the scheme boundary) of which are veteran trees on the ancient woodland inventory have been assessed at **national importance level**. Details of woodland and tree assessment, including location of veteran trees, is set out in arboricultural survey in ES Chapter 7 Landscape, Appendix 7.6 (**TR010037/APP/6.3**).

## Hedgerow

- 8.7.15. In total 20 hedgerows were surveyed in June and July 2017 for species richness whilst gathering sufficient information to judge whether the hedgerow was likely to be important under the Hedgerow Regulations 1997.
- 8.7.16. Four of the hedgerows were classed as important under the assessed criteria for of the Hedgerow Regulations 1997. Two additional hedgerows were classed as species rich.

## Botanical survey

- 8.7.17. A botanical survey was undertaken in June 2017 off all arable fields and grassland habitats in the study area. A more in-depth National Vegetation Classification (NVC) survey was conducted on Meadow Farm Meadows CWS as these areas were identified as requiring further detailed surveys in the Stage 2 assessment. The botanical survey confirmed the value of the Meadow Farm Meadows CWS and therefore it is assessed as a biodiversity resource of value at a **county importance level**.

- 8.7.18. Two nationally scarce plants, hoary mullein (*Verbascum pulverulentum*) and bearded fescue (*Festuca subulate*) were identified in good numbers during the grassland survey in the field west of the Meadow Farm Meadows CWS (within the RLB). These populations are classed as a biodiversity resource of value at a **local importance level**. Bearded fescue was not identified in 2020 surveys. Further details can be found in ES Appendix 8.1 (**TR010037/APP/6.3**).
- 8.7.19. Two of the arable fields surveyed were assessed as supporting arable plants at a **local importance value**.
- 8.7.20. Further surveys were undertaken in June and July 2020 which identified the following Near-threatened red data book species:
- Common cudweed *Filago vulgaris*
  - Smooth catsear *Hypochaeris glabra*
  - Corn spurrey *Spergula arvensis*
- 8.7.21. While these species are given an elevated ecological status nationally, they are all relatively frequently encountered at a local scale, especially in light soils, and are often associated with soil disturbance and brownfield land.

### Terrestrial invertebrates

- 8.7.22. Six survey visits were undertaken during May, June and August 2017. During these surveys, 598 species were recorded which consisted of four Nationally Rare (Red Data Book) species and two cited within NERC Act (2006) Section 41;
- the ground beetle *Omophron limbatum*
  - the rove beetles *Cypha seminulum* and *Tachinus flavolimbatus*
  - the Five-banded Weevil-wasp *Cerceris quinquefasciata*
  - Cinnabar moth *Tyria jacobaeae*
- 8.7.23. Eighteen species recorded were of nationally scarce status.
- 8.7.24. Updated surveys were conducted during four visits in May, June, July and August 2020 whereby 502 species were recorded including 27 of conservation concern. Further details can be found in ES Appendix 8.2. The following Nationally Rare species were recorded:
- the beetles *Omophron limbatum*, *Quedius dilatatus* and *Aulonothroscus brevicollis*;
  - the solitary wasps *Cerceris quinquefasciata* (also S41 NERC Act 2006) and *Hedychrum niemelai*
  - the tachinid fly *Cistogaster globosa*.



8.7.25. The terrestrial invertebrate assembly has been assessed as a biodiversity resource of **local level** importance.

### Aquatic invertebrates

8.7.26. Surveys were carried out in March and September 2017. Notable species were identified in the balancing ponds, Meadow Farm meadow pond and the fishing lakes close to the rail line at Meadow Farm Cottages and include:

- *Planaria torva*
- Smooth ramshorn *Gyraulus laevis*
- *Helocares lividus*
- Ornate brigadier *Odontomyia ornata*

8.7.27. Updated surveys were carried out in June and August 2020. During this survey 100 taxa of vertebrate and invertebrate were recorded, of which 63 were identified to species level. Notable species include:

- *Chaetarthria seminulum*
- *Helocares lividus*
- *Rhantus grapii*
- *Helophorus alternans*

8.7.28. No aquatic macroinvertebrates that receive specific legal protection by way of Schedule 5 of the Wildlife and Countryside Act (1981) or are listed on Section 41 of the NERC Act (2006) (Table 5.2) as being of principal importance for nature conservation in England were recorded. The aquatic invertebrate assembly has been assessed as a biodiversity resource of **local level** importance. Full details can be found in ES Appendix 8.3 (**TR010037/APP/6.3**).

### Great Crested Newt

8.7.29. Initial great crested newt (GCN) surveys were undertaken in 2016 which included a desk study and an assessment of Habitat Suitability Index (HSI) of all accessible ponds (nine) within 500m of the study area. Five waterbodies with below average or above average habitat suitability to support this species were identified and Environmental DNA (eDNA) surveys were carried out on these ponds in April 2017. The results of these surveys returned negative results for all ponds.

8.7.30. The HSI assessment was updated in March and June 2020 whereby 27 ponds were identified. Of these 27 ponds, only 11 were able to be accessed for assessment due to access restrictions. From these 11 waterbodies, nine were



considered suitable to support GCN. Of these nine ponds, six were subject to eDNA water sampling in June 2020. The results of these surveys returned negative results for all six ponds. Full details can be found in ES Appendix 8.4 (TR010037/APP/6.3).

8.7.31. In order to confirm either the presence or likely absence of GCN within the Proposed Scheme DCO boundary and confirm or negate the need for licence and mitigation the following surveys shall be undertaken in 2021 prior to works commencing:

- eDNA surveys of three waterbodies
- a second walkover of one waterbody and, should water be present, a HSI assessment and subsequent eDNA survey should the waterbody be suitable
- HSI assessments of all waterbodies within the survey area which have not already been subject to HSI based on the most recent design
- eDNA survey of waterbodies within the survey area scoring 'below average' HSI or above which have not already been subject to eDNA following the HSI assessments in the point above

## Reptiles

8.7.32. Reptile surveys were undertaken in April, May, August and September 2017 in all suitable habitat identified during the Phase 1 Habitat survey (2016). A maximum count of two grass snake (*Natrix natrix*) were recorded to the west of the A11 in the semi-improved grassland/young plantation habitat and adjacent to the stream to the east of the A11 (TG 17996 05002). A single male common lizard (*Zootoca vivipara*) was recorded in grassland to the south of the A11. Updated surveys were conducted throughout July, August and September 2020. In total, one adder (*Vipera berus*), two common lizard and five juvenile grass snakes were recorded. This population of adder, grass snake and common lizard on site is classified as 'low'<sup>3</sup>. Full details can be found in ES Appendix 8.5.

8.7.33. The low population of reptiles has been assessed as a biodiversity resource of **county importance** as although common lizard and grass snake are listed on the East of England Priority Species List, the low numbers of reptiles which are widespread across the region, would not make the population especially of regional importance.

<sup>3</sup> Based on the criteria outlined in Froglife (1999) Froglife Advice Sheet 10: 'Reptile Survey– an introduction to planning, conducting and interpreting surveys for snake and lizard conservation'.

## Birds

### Breeding

8.7.34. An initial breeding bird survey was undertaken during April, May and June 2017 covering all suitable breeding bird habitat within the study area. In total 49 species were recorded as likely to be breeding within or close to the study area. Notable species cited in the WCA or NERC Act (2006) include:

- Barn owl, *Tyto alba*
- Bullfinch, *Pyrrhula pyrrhula*
- Dunnock, *Prunella modularis*
- Hobby, *Falco subbuteo*
- House sparrow, *Passer domesticus*
- Kingfisher, *Alcedo atthis*
- Linnet, *Linaria cannabina*
- Skylark, *Alauda arvensis*
- Song thrush, *Turdus philomelos*
- Starling, *Sturnus vulgaris*

8.7.35. In addition, there were seven birds cited on the Birds of Conservation Concern (BoCC) Amber List and seven on the BoCC Red List.

8.7.36. Updated surveys were carried out in March, April, May and June 2020 where a total of 44 bird species were recorded within the study area. In addition to the above, notable species cited on the NERC Act (2006) included herring gull. In addition, there were seven BoCC red-listed species and six BoCC amber-listed species.

8.7.37. The species recorded are resident and regular breeding species within the region. At the species value level, the site is considered to be of **local conservation** value<sup>4</sup>. Full details can be found in ES Appendix 8.6 (TR010037/APP/6.3).

### Wintering

8.7.38. Surveys were undertaken in January, February and March 2017 covering all suitable wintering bird habitat within the study area. Forty-six species were recorded during the three wintering bird surveys. Notable species cited in the WCA or NERC Act include:

- Dunnock
- Herring gull, *Larus argentatus*

- House sparrow
- Redwing, *Turdus iliacus*
- Skylark
- Song thrush

8.7.39. In addition, there were eight species cited on the Birds of Conservation Concern (BoCC) Amber List and nine species on the BoCC Red List.

8.7.40. Updated surveys were carried on in January, February, November and December 2019. A total of 42 species were recorded within the site boundary during the surveys. In addition to the above, notable species cited in the WCA or NERC Act (2006) include:

- Bullfinch
- Fieldfare, *Turdus pilaris*
- Linnet
- Starling

8.7.41. In addition, nine species were cited on the BOCC red-listed and six species on the BoCC amber list.

8.7.42. The overall assemblage of bird species recorded on site was typical of the range of habitat present and the site falls within the range of species assemblages of local importance<sup>4</sup>. Most of the species recorded are resident and regular wintering species within the region. At the species value level, the site is considered to be of **local conservation value**<sup>4</sup>. Full details can be found in ES Appendix 8.7 (**TR010037/APP/6.3**).

### *Hobby*

8.7.43. A targeted hobby survey was undertaken on 27 July, 21 and 23 August and 19 September 2017. This targeted survey was deemed necessary as the species can be extremely elusive during the breeding season and therefore easily missed during a standard breeding bird survey. An adult hunting was recorded on two occasions in August and a pair of adults feeding two young were recorded in September approximately 1.4km south-east of the Thickthorn Roundabout and 600m south of the study area.

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<sup>4</sup> Using the criteria outlined by Fuller (1980), A Method for Assessing the Ornithological Importance of Sites for Nature Conservation Biological Conservation 17:229-239

- 8.7.44. An updated survey was carried in out May, June, August and September 2020 however the surveys did not record any hobby. Full details can be found in ES Appendix 8.6 (**TR010037/APP/6.3**).
- 8.7.45. There has been no evidence of hobby breeding within the study area and no evidence of any birds were identified during the survey in 2020. It is concluded that hobby is not present on site and as such have been scoped out of this assessment.

### *Barn owl*

- 8.7.46. All buildings which might support breeding barn owl within 1.5km of the study area were considered. One building at [REDACTED] was found to contain a nest box which had been used successfully by barn owl in 2016. An internal building inspection in 2017 identified fresh pellets and it was assumed that barn owls were nesting in the nest box.
- 8.7.47. An updated survey in September 2020 identified an additional three areas suitable for barn owl. Of the four sites checked, breeding was again confirmed at [REDACTED] Full details can be found in ES Appendix 8.6.
- 8.7.48. The barn owl assemblage has been assessed as a biodiversity resource of **county level** importance due to its citation within the Norfolk Biodiversity Action Plans.

### **Bat**

#### *Bat roosts*

- 8.7.49. Preliminary roost appraisals were undertaken in 2016 and 2017. Aerial inspections of 27 trees were undertaken in April 2017 and ten trees with high or moderate bat roost potential (BRP) were identified. The A47 footbridge (TG 18749 05102) and A11 underpass (TG 17930 04860) were assessed as negligible risk with regards to roosting bats.
- 8.7.50. Dusk emergence and dawn re-entry surveys undertaken in 2017 confirmed two trees with day roosts of soprano pipistrelle *Pipistrellus pygmaeus* and concluded further pipistrelle roosts were likely present in residential areas near Cantley Lane and Cantley Lane South.
- 8.7.51. In 2018, further dusk emergence/dawn re-entry roost surveys were undertaken on the two previously confirmed tree roosts. Roosting behaviour was confirmed in both trees with the roosts characterised as occasional day roosts for single or small numbers of soprano pipistrelles. A third soprano pipistrelle day roost was incidentally identified during the surveys in a sycamore *Acer pseudoplatanus* tree close to one of the trees being surveyed.

- 8.7.52. The dusk emergence and dawn re-entry surveys were updated in 2020. No roosting bats were found in one tree previously identified as a roost or in the adjacent tree that had a roost recorded incidentally. This tree additionally had an endoscope survey which found no evidence of recent bat use. In the other tree roost previously surveyed in 2017 and 2018, a common pipistrelle *Pipistrellus pipistrellus* day roost was confirmed and a potential noctule *Nyctalus noctule* roost was observed. Along the tree line where this tree is located, two further trees had roosts recorded, one had a day roost with one common pipistrelle and one soprano pipistrelle and potentially two noctules and the other had a day roost with one common pipistrelle and one noctule.
- 8.7.53. All trees within 50m of the DCO boundary had an update ground level bat roost potential assessment on 22 and 29 July 2020. Fifteen trees had moderate or high bat roost potential within the DCO boundary and would be disturbed or lost under the latest Scheme. As the roost survey data previously collected will be out of date, further aerial climbing or dusk emergence and dawn re-entry surveys will be undertaken between May and September 2021. Full details can be found in ES Appendix 8.8 **(TR010037/APP/6.3)**.

#### *Bat activity*

- 8.7.54. Bat activity surveys were previously undertaken at the site between April 2017 and October 2019 based upon an assessment which concluded moderate habitat suitability for bats. Seven species of bat were recording on site; common pipistrelle, soprano pipistrelle, Daubenton's *Myotis daubentonii*, noctule, brown long-eared *Plecotus auritus*, serotine *Eptesicus serotinus* and very low numbers of barbastelle *Barbastella barbastellus*.
- 8.7.55. Four areas of relatively high bat activity were identified during the surveys; the woodland west of the Thickthorn services, along Cantley Lane north and south of the A47, a woodland edge and Cantley Stream east of the A11 and the fishing lakes. Full details can be found in ES Appendix 8.8 **(TR010037/APP/6.3)**.

#### *Bat crossing point activity*

- 8.7.56. In 2020, two surveyed locations were chosen for further investigation as potential bat crossing points based primarily on the presence of current linear features on-site perpendicular to the A47 and A11 which could potentially provide a commuting route for the local bat populations. The following sources of baseline information were also taken into consideration when choosing the survey locations:

- the results of the previous bat activity surveys undertaken in 2017
- the results of bat roost surveys previously undertaken in 2017 and 2018

- the Proposed Scheme design

- 8.7.57. The first crossing point location was the Cantley Stream A11 underpass which is to be widened. The underpass was found to have a small number of common and soprano pipistrelle and a single *Myotis* sp. (maximum of six in an hour) crossing under the underpass and very few common and soprano pipistrelles and a single *Myotis* sp. (maximum of one in an hour) crossing over the A11 at heights of at least 12m. The underpass was also found to be a foraging resource for more common pipistrelle species.
- 8.7.58. The second crossing point location was Cantley Lane footbridge over the A47, south of the A47 Thickthorn Junction. The footbridge was found to have a maximum of five common and soprano pipistrelles and possible brown long-eared bats crossing over the road in an hour at a minimum height of 10m. Bats were seen crossing the road to the north west of the footbridge closer to where Cantley Lane ends at the A47.
- 8.7.59. Bats within the study area have been assessed as of **county importance value** based on the presence of individual rarer species and large numbers of common species and low numbers of nearby roosts. Full details can be found in ES Appendix 8.8 (**TR010037/APP/6.3**).

## Otter

- 8.7.60. An initial otter survey was undertaken in April, May and September 2017 focussing on the waterbodies which were identified during the PEA in 2016. A spraint was recorded at the fishing lakes and at the A11 underpass along with incidental records received via camera traps during the polecat survey (2017).
- 8.7.61. Incidental records were noted of a spraint on a ledge in the culvert under the A47 and anal jelly on a footbridge north of the A11 underpass during the polecat survey 2018. Further otter surveys and spot checks of bridges were conducted between July and September 2018 where footprints and spraints were recorded around the A11 underpass, east of the A47 culvert and on ledges within the culvert and in the culvert underneath Intwood Road approximately 500m east of the Scheme.
- 8.7.62. Update surveys were carried out in May and October 2020. During October five potential otter holts were identified, two of which were not used by otters. One due to flooding of the cavity and the other thought to be a hover, as no underground cavity was present. Field signs of spraint and footprints along Cantley Stream indicate they use the area.



- 8.7.63. Surveys of the potential holts with cameras were undertaken in December 2020. Results from this survey showed that no otters were identified as using the remaining holts.
- 8.7.64. Otters are a European Protected Species, fully protected by the Wildlife and Countryside Act (1981) as amended and are listed on the East of England and Norfolk BAP. Populations are increasing nationally and in Norfolk. The importance of the otter within the site as a resource has been assessed as of **county importance biodiversity value**. Full details can be found in ES Appendix 8.9 (TR010037/APP/6.3).

### Water Vole

- 8.7.65. Initial water vole surveys were undertaken in April, May and September 2017 within at least 5m of the channel of any waterbody/ watercourse. These habitats comprised a balancing pond (TG 18980 05696), field pond (TG 19290 04920), fishing lakes (TG 18890 04854) and Cantley Stream. Evidence in the form of three burrows, ten latrines, footprints and feeding remains were recorded on Cantley Stream north and south of the underpass beneath the A11.
- 8.7.66. Further surveys were carried out in July and September 2018 where water vole evidence was in abundance along Cantley Stream north and south of the underpass beneath the A11 and east of the A47 culvert. Footprints were also noted during the otter surveys on the watercourse beneath Keswick Road (approximately 1130m east of the Proposed Scheme).
- 8.7.67. Update surveys were carried out in May and October 2020 which found latrines, burrows, pathways, footprints and an actual sighting of water voles. From latrine numbers relative high densities of water voles along parts of Cantley Stream which are to be realigned have been calculated. The highest numbers of water voles were found where habitat cover and water depths were favourable.
- 8.7.68. The population of water vole has been assessed as a biodiversity resource of **county importance value** due to the decrease of water vole in the county as a result of fragmentation, habitat loss, poor water level management and predation by American mink *Neovison vison* and its inclusion on the county BAP. It is listed on the East of England BAP, although the good population present is not unusual as Norfolk is a stronghold for the species in the UK. Full details can be found in ES Appendix 8.9 (TR010037/APP/6.3).

### Polecat

- 8.7.69. During May 2017 a polecat (or polecat hybrid) was noted as a road casualty and further surveys were carried out during August and September 2017 where four footprint tunnels and trail cameras were installed. No footprints or definitive

images of polecat were recorded during the survey or on the trail cameras. A possible polecat or hybrid was recorded on the trail camera at the A11 underpass in September 2017. Trails cameras were redeployed in January to March 2018 however no images of polecat were recorded.

- 8.7.70. Further surveys were undertaken between February and June 2020 using trail cameras. A single polecat-ferret hybrid *Mustela putorius x Mustela putorius furo* was observed in March 2020 but no European polecat were recorded.
- 8.7.71. Polecat is listed as a species of principal importance under Section 41 of the NERC Act 2006 and on the East of England BAP. The polecat population has been assessed as a biodiversity resource of regional level importance. However, as all surveys concluded with negative results it can be assumed that polecat are not present within the study area and as such, have been scoped out of further assessment. Full details can be found in ES Appendix 8.10 **(TR010037/APP/6.3)**.

## Badger

- 8.7.72. Initial badger surveys were carried out in January and March 2017 and trail cameras were installed in August and September 2017. Badgers were recorded as road casualties on A11 and A47 throughout March 2017 and at least one was caught on a trail camera using the A11 underpass. No signs of setts or definitive field signs (latrines) were recorded. During the polecat survey in 2018 badgers were recorded on four trail cameras and two badger setts were located along an arable field margin [REDACTED] within the DCO boundary.
- 8.7.73. Further surveys were undertaken in October 2019. The two setts which were identified during the polecat survey in 2018 were assessed as being partially used. Two further partially active setts were located south of the DCO boundary within [REDACTED]. Incidental records of badger were also made on camera traps whilst surveying for polecat between March and May 2020.
- 8.7.74. The badger population on-site has been assessed as a biodiversity resource of value at a **local importance level**. Full details can be found in ES Appendix 8.11 **(TR010037/APP/6.3)**.

## Invasive

### *Schedule 9 Wildlife and Countryside Act (1981)*

- 8.7.75. During the PEA (2016) two small stands 20m<sup>2</sup> and 1m<sup>2</sup> of Japanese knotweed (*Fallopia japonica*) were recorded and giant hogweed (*Heracleum mantegazzianum*) was also reported near the A47 outside the DCO boundary to the north.



- 8.7.76. Reeves's Muntjac (*Muntiacus reevesi*) were seen regularly during the 2017 and 2020 polecat survey, badger survey (2017, 2018) and otter survey 2018.
- 8.7.77. During the badger survey in 2019 both *Rhododendron ponticum* and *Cotoneaster* sp. were found in woodland west of Intwood Road and south of the A47 approximately 750m south of the DCO boundary.
- 8.7.78. During the 2020 botanical survey a stand of cotoneaster was recorded within 'Unit Y'. The southern part of this unit lies within the DCO boundary. It is not known where the exact location of this plant was. Furthermore, an incidental observation of Himalayan cotoneaster (*Cotoneaster simonsii*) was recorded during the reptile survey on the bank of the A11, north of the Cantley Stream underpass (TG 17954 04865) within the DCO boundary.

#### *Invasive non-native*

- 8.7.79. The invasive freshwater shrimp *Crangonyx pseudogracilis* was recorded during the aquatic invertebrate survey in 2020 within the balancing pond, Cantley Stream, fishing lakes and Meadow Farm Meadows CWS pond.

#### **Other notable species**

- 8.7.80. Common Toad (*Bufo bufo*) were recorded during the reptile survey in 2017 and during GCN surveys in March 2020. Common toad is cited on Section 41 of the NERC Act 2006. The common toad population on-site has been assessed as a biodiversity resource of value at a **local importance level**.
- 8.7.81. West European hedgehog (*Erinaceus europaeus*) was recorded on one occasion during a bat survey in April 2017 and also on a camera trap during polecat surveys in 2020. This species is cited on Section 41 of the NERC Act 2006. The West European hedgehog population on-site has been assessed as a biodiversity resource of value at a **local importance level**.
- 8.7.82. Although not assessed to date, common fish species may be present within the Cantley Stream. Those fish species may include those cited on the NERC Act 2006. If these species are present, they would be assessed as a biodiversity resource of local importance level. Valuation of ecological receptors
- 8.7.83. The assessment criteria for the valuation of ecological importance of receptors are detailed in section 8.4 of the chapter.
- 8.7.84. A summary of the resource importance valuation of ecological receptors relevant to the Proposed Scheme is provided in Table 8-6: Summary of valuation of ecological receptors.

Table 8-6 Summary of valuation of ecological receptors

Ecological Receptor	Resource importance valuation
The Broads SAC and Broadland SPA and Ramsar	International
Eaton Chalk Pit SSSI	National
Eaton Common, Earlham Park Woods and Marston Marshes LNR	Local
CWS (refer to section 8.7.6 and Table 8-5)	County
NERC Act (2006) priority habitats present within study area include lowland fens, traditional orchards, rivers, hedgerows, coastal and floodplain grazing marsh, standing water (ponds), arable field margins, lowland mixed and deciduous woodland, wood pasture and parkland and lowland meadows.	National
Scattered mature veteran trees	National
Norfolk BAP Priority Habitats present include cereal field margin, hedgerows, lowland wood pasture and parkland, mixed deciduous woodland	County
Other Habitats within the study area including Semi-improved, amenity and improved grassland, tall ruderal, buildings, bare ground and dense and scattered scrub	Negligible
Botanical habitats and species	Local
Terrestrial invertebrates	Local
Aquatic invertebrates	Local
Great crested newt	County
Reptile	County
Breeding birds	Local
Wintering birds	Local
Barn owl	County
Bat	County
Otter	County
Water vole	County
Polecat	Regional
Badger	Local (Legal constraints apply)

Ecological Receptor	Resource importance valuation
Invasive species	Negligible (Legal constraints apply)
Other notable species (Common toad, hedgehog and fish species)	Local

8.7.85. Ecological receptors given a resource importance value of local or above have been taken forward for further assessment. INNS have been taken forward, although they have negligible importance as a biodiversity resource, as legal constraints apply to their management and disturbance.

## 8.8. Potential impacts

### Internationally designated sites

- 8.8.1. No works will take place within The Broads SAC or Broadland SPA and Ramsar, therefore no direct impacts are anticipated. Negative impacts are likely to be indirect and a result of changes in water quality. While none of these sites lies within the Proposed Scheme boundary, or within 2km, there is potential for effect pathways to exist between the Proposed Scheme and the Broads SAC and Broadland SPA and Ramsar sites through changes in drainage affecting watercourses that flow into the River Yare.
- 8.8.2. Chapter 13 (Road drainage and water environment) (**TR010037/APP/6.1**) states that without the adoption of standard construction best practice methods, there is the potential for mobilisation of sediment and contaminants from surface water runoff into drainage ditches and ponds.
- 8.8.3. A Habitats Regulations Screening Assessment (HRA) (**TR010037/APP/6.9**) has been undertaken for the Proposed Scheme. The findings of the HRA show no likely significant effects on any of the qualifying features of the SAC, SPA and Ramsar sites before mitigation, so designated sites have been scoped out of this assessment (for both construction and operation).

### Construction (permanent and temporary impacts)

- 8.8.4. The potential impacts pathways which may arise during the construction stage include:
- Site clearance and the land take of habitats
  - Creation of barriers along habitats decreasing site connectivity and increasing fragmentation
  - Physical damage to on site vegetation from smothering via soil piles

- Damage to root systems
- Changes to soil chemistry
- Increase surface water run off changing local hydrological patterns and impacts on water quality through sedimentation
- Damage of watercourses and habitats through accidental spillages of pollutants (chemical)
- The change in natural on-site hydrological flow
- Loss of foraging habitats for breeding and wintering species due to fragmentation of the site and severance of linear features such as hedgerows.
- Increased atmospheric, noise, vibration and light pollution during construction
- Noise and visual disturbance resulting in the dispersion of sensitive ecological receptors within and adjacent to the construction footprint
- Direct mortality of local fauna due to site plant collisions or earthworks
- Spreading of invasive species and disease through the movement of plant.

8.8.5. The predicted ecological impacts (without mitigation) from construction for the Proposed Scheme are presented in Table 8-7.

Table 8-7 Impact assessment on ecological receptors during construction (unmitigated)

Ecological Receptors	Resource importance	Description of impact
Eaton Chalk Pit SSSI	National	Indirect impacts during construction through increased air pollution.
Eaton Common, Earlham Park Woods and Marston Marshes LNR	Local	Direct impacts from pollution of habitat within Eaton Common and Marston Marshes LNR through surface water runoff, water level changes and sedimentation and accidental spillages.  Indirect impacts on Earlham Park Wood LNR from pollution of habitat from air quality.
CWS (refer to section 8.7.6 and Table 8-5)	County	Direct impact on Meadow Farm Meadows (east) CWS through temporary habitat loss.  Potential of indirect impacts upon all CWSs from pollution of habitat from air quality and surface water runoff, water level changes, sedimentation and accidental spillages
NERC Act (2006) priority habitats present within study area include lowland fens, traditional orchards,	National	Permanent loss of hedgerows, lowland meadows, and deciduous woodland

Ecological Receptors	Resource importance	Description of impact
arable field margins, rivers, hedgerows, coastal and floodplain grazing marsh, standing water (ponds), lowland mixed deciduous woodland, wood pasture and parkland and lowland meadows.		Indirect effects on lowland fens, arable field margins, coastal and floodplain grazing marsh, ponds, rivers, deciduous woodland, standing water and hedgerows from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages
		No direct or indirect impacts predicted upon traditional orchards due to the distance from the works area, and woodland pasture and parkland.
Scattered mature and veteran trees	National	Two veteran trees will be removed. Impacts will be permanent and direct.. Those to be retained, impacts will be indirect from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages
Norfolk BAP Priority Habitats present include cereal field margin, hedgerows, lowland wood pasture and parkland, mixed deciduous woodland	County	Permanent loss of hedgerows and deciduous woodland.  No direct impacts on lowland wood pasture and parkland and cereal field margins. indirect impacts from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages
Botanical	Local	Direct impacts include loss of the botany within the Meadow Farm Meadow and old woodland habitat and through the adjustment of the drainage ditches leading to water level change.
Terrestrial invertebrate	Local	Removal of habitat (permanent). Risk of population decline through habitat fragmentation. Habitat degradation through pollution events from dust and accidental spills. Disturbance from light pollution (temporary).
Aquatic invertebrate	Local	Removal of habitat (permanent). Pollution risk of mortality of individuals from dust and accidental spills and changes to water levels and habitat suitability for common aquatic invertebrates. Disturbance from light pollution (temporary).
Great crested newt (if found in remaining surveys to be completed)	County	Direct mortality of individuals during vegetation clearance and from collisions with construction traffic, entrapment in excavations, disturbance of places of shelter leading to abandonment. Loss of supporting and breeding habitat.
Reptile	County	Direct mortality of individuals during vegetation clearance and from collisions with construction traffic, entrapment in excavations, disturbance of places of shelter leading to abandonment. Loss of supporting and breeding habitat.
Breeding birds	Local	Direct mortality of individuals from site clearance of vegetation during breeding season, disturbance of

Ecological Receptors	Resource importance	Description of impact
		<p>nesting locations from water, noise and light pollution. Collisions with construction traffic.</p> <p>Loss, obstruction and disturbance of foraging and loafing habitat of breeding individuals from the fishing lake, streams and river, noise and light pollution leading to abandonment of area.</p>
Wintering birds	Local	<p>Direct mortality of individuals from site clearance of vegetation, disturbance of foraging and loafing locations from fishing lake, river and streams, noise and light pollution. Collisions with construction traffic.</p> <p>Loss, obstruction and disturbance of key foraging and loafing habitat such as cereal crop and wintering crops leading to abandonment of area.</p>
Barn owl	County	<p>Direct mortality of individuals from site clearance of vegetation during breeding season, disturbance of nesting locations from noise and light pollution.</p> <p>Loss of foraging habitat and suitable roosting habitat.</p>
Bat	County	<p>Direct mortality through roost destruction during removal of tree roosts (permanent). Disturbance of known bat roosts from noise, vibration and light (temporary).</p> <p>Permanent loss of foraging habitat, severance of commuting routes and foraging areas, resulting in avoidance and abandonment of habitats and roosts.</p>
Otter	County	<p>Direct mortality or injury of individuals from construction traffic and being trapped in excavations.</p> <p>Pollution risk of mortality of individuals from dust and accidental spills and changes to habitat suitability from sedimentation and water level changes. Disturbance from noise and light pollution leading to abandonment of foraging areas and resting places (temporary).</p>
Water Vole	County	<p>Direct mortality of individuals during vegetation clearance, stream dredging and realignment and collisions from construction traffic, and loss of habitat in fenland area.</p> <p>This population will incur a pollution risk of mortality of individuals from dust and accidental spills and changes to habitat suitability from sedimentation and water level changes. Disturbance from noise and light pollution (temporary).</p>
Badger	Local (Legal constraints apply)	<p>Permanent loss of potential commuting and foraging habitat from badgers in setts close to works but not within physical disturbance range.</p> <p>Disturbance from noise and light levels. Potential of death or injury of individuals from falling in excavations.</p>

Ecological Receptors	Resource importance	Description of impact
Invasive	Negligible (Legal constraints apply)	Introduction and spread of diseases during construction could result in death of plants and animals (examples: Ash dieback, ranavirus) (permanent). Introduction and assisted spread of invasive species during construction may result in squeezing out of native habitats and species. (temporary)
Other notable species (Common toad, hedgehog and fish species)	Local	<p>Permanent loss of commuting routes and areas of shelter and foraging.</p> <p>Direct mortality of individuals from collisions with construction traffic, entrapment in excavations.</p> <p>Disturbance from noise and light pollution of places of shelter leading to abandonment.</p> <p>Pollution risk of mortality of individuals from dust and accidental spills and changes to habitat suitability from sedimentation and water level changes.</p> <p>Direct mortality of fish species during instream works.</p>

## Operation (permanent impacts)

8.8.6. The potential impacts associated with the operational stage of the proposed works include:

- Barrier effect of new road caused by increased width
- Disturbance of breeding species and their resting places due to light spill
- Mortality of local flora and fauna due to pollution events and spills
- Direct mortality of species due to road traffic collisions (RTC)
- Flood events or drying out of watercourses and wetland habitats
- Vegetation clearance for maintenance of roads, verges and associated infrastructure

8.8.7. The predicted ecological impacts (without mitigation) from operation for the Proposed Scheme are presented in Table 8-8:

Table 8-8 Impact assessment on ecological receptors during operation (unmitigated)

Ecological Receptors	Resource importance	Description of impact
Eaton Chalk Pit SSSI	National	No impacts.
Eaton Common, Earlham Park Woods and Marston Marshes LNR	Local	No direct impacts.



Ecological Receptors	Resource importance	Description of impact
		Indirect impacts during operation from surface water run-off, sedimentation, water level changes.
CWS (refer to section 8.7.6 and Table 8-5)	County	<p>Direct impacts during operation on Meadow Farm Meadows through water level change, surface water run-off and pollution gradually degrading habitats</p> <p>Indirect impacts during operation from surface water run-off, sedimentation, water level changes, gradually degrading habitats.</p>
NERC Act (2006) priority habitats present within study area include lowland fens, traditional orchards, rivers, arable field margins, hedgerows, coastal and floodplain grazing marsh, standing water (ponds), lowland mixed deciduous woodland, wood pasture and parkland and lowland meadows.	National	<p>No direct or indirect impacts predicted upon traditional orchards, woodland pasture and parkland due to the distance from the works area</p> <p>Indirect impacts upon all other habitats during operation from surface water run-off, sedimentation, water level changes, gradually degrading habitats.</p>
Scattered mature and veteran trees	National	Trees remaining - impacts will be indirect from pollution of habitat, surface water runoff, sedimentation and accidental spillages
Norfolk BAP Priority Habitats present include cereal field margin, hedgerows, lowland wood pasture and parkland, mixed deciduous woodland	County	Indirect impacts upon hedgerows and deciduous woodland through the pollution of habitats from surface water runoff, sedimentation, water level changes and air pollution gradually degrading habitats.
Botanical	Local	Indirect impacts on botanical composition during operation from surface water run-off, sedimentation, water level changes, gradually degrading habitats.
Terrestrial Invertebrate	Local	<p>Reduction in abundance due to the presence of a physical barrier which will reduce dispersal of species.</p> <p>Potential risk of mortality of individuals through pollution from surface water runoff, sedimentation, water level changes and habitat suitability for common aquatic invertebrates. Disturbance from light pollution (permanent).</p>
Aquatic Invertebrate	Local	Potential risk of mortality of individuals from pollution from surface water runoff, sedimentation, water level changes and habitat suitability for common aquatic invertebrates. Disturbance from light pollution (permanent).

Ecological Receptors	Resource importance	Description of impact
Great crested newt (if found in remaining surveys to be completed)	County	Pollution of breeding ponds from surface water run-off carrying contaminants and pollutants due to increased area of hard-standing. Loss of terrestrial habitat. Changes to habitat suitability through pollution.
Reptile	County	Reduction in abundance due to the presence of a physical barrier which will reduce dispersal of species.  Changes to habitat suitability for reptiles through surface water run-off.
Breeding birds	Local	Direct mortality of individuals through traffic collisions due to wider junction and road.  Disturbance of nesting locations from noise and light pollution. Water pollution may also affect nesting and feeding for wildfowl species.  Degradation of habitat and obstruction and disturbance of foraging and loafing on individuals from water and light pollution leading to abandonment of area.
Wintering birds	Local	Direct mortality of individuals through traffic collisions due to wider junction and road.  Disturbance of foraging and loafing locations from noise and light pollution.  Degradation of habitat and the obstruction and disturbance of foraging and loafing areas from water and light pollution leading to abandonment of area.
Barn owl	County	Disturbance of nesting locations from noise and light pollution. Mortality from the increased potential for collisions with traffic.  Loss, obstruction and disturbance of foraging habitat of breeding individuals from noise and light pollution leading to abandonment of area.
Bat	County	Direct mortality of individuals due to traffic collisions caused by road widening.  Pollution of water courses and degradation of habitats could lead to reduction in prey availability  Disturbance for noise, vibration or light spill resulting in permanent avoidance and abandonment of foraging habitats, commuting routes and roosts.
Otter	County	Direct mortality of individuals through traffic collisions due to new wider junction and road.  Potential risk of mortality of individuals from surface water runoff, sedimentation, water level changes and decreased habitat suitability for otters.

Ecological Receptors	Resource importance	Description of impact
		Disturbance from light pollution (permanent).
Water Vole	County	<p>Potential risk of mortality of individuals from pollution through increased surface water runoff, sedimentation, water level changes and decreased habitat suitability for water voles.</p> <p>Avoidance and abandonment of burrows due to new culvert and stream realignment.</p> <p>Disturbance from light pollution (permanent).</p>
Badger	Local (Legal constraints apply)	<p>No direct impacts to setts. Potential flood events from the realigned Cantley Stream and associated overflow areas.</p> <p>Direct mortality of individuals through traffic collisions due to wider junction and new roads.</p> <p>Disturbance from noise and light levels.</p>
Invasive species	Negligible (Legal constraints apply)	No operational impacts anticipated
Other notable species (Common toad, hedgehog and fish species)	Local	<p>Direct mortality of individuals through traffic collisions due to wider junction and road.</p> <p>Risk of mortality of individuals from surface water runoff, sedimentation, water level changes and reduction in habitat suitability. Disturbance from light pollution (permanent).</p>

## 8.9. Design, mitigation and enhancement measures

- 8.9.1. This section presents an overview of mitigation measures proposed in response to the impacts identified. The purpose of these measures is to avoid or reduce the ecological effects associated with the construction and operation of the Proposed Scheme and maximise benefits.
- 8.9.2. Guidance on best practice in relation to pollution prevention and water management is set out in Construction Industry Research and Information Association (CIRIA) Guidelines ((Soubry (2001), Murnane *et al.* (2006), Charles and Edwards (2015)), and the Environment Agency’s approach to groundwater protection (Environment Agency, 2017) and groundwater protection guides (Environment Agency, 2017a), as required under the Water Framework Directive.
- 8.9.3. All mitigation will be detailed and implemented as part of the record of environmental actions and commitments (REAC) in Table 3-1 of the Environmental Management Plan (EMP) (**TR010037/APP/7.4**). Newly created or enhanced habitats will be managed and monitored for five years after planting.

8.9.4. Mitigation measures employed to reduce the impact of the Proposed Scheme on ecological receptors as outlined in LA108 (3.14) and LA104 (3.23) have been categorised using a hierarchical system as follows and are detailed in Tables 8-9 and 8-10.

- avoidance and prevention: design and mitigation measures to prevent the effect (for example alternative design options or avoidance of environmentally sensitive sites).
- reduction: where avoidance is not possible, then mitigation is used to lessen the magnitude or significance of effects.
- remediation: where it is not possible to avoid or reduce a significant adverse effect, these are measures to offset the effect, such as compensatory habitat creation.

Table 8-9 Ecological design and mitigation measures (Construction)

Ecological receptor	Description of impact (Construction)	Mitigation
Eaton Chalk Pit SSSI	Indirect impacts during construction through increase air pollution.	Reduction of as much permanent habitat loss as possible has been embedded in the design.
Eaton Common, Earham Park Woods and Marston Marshes LNR	<p>Direct impacts from pollution of habitat within Eaton Common and Marston Marshes LNR through surface water runoff, water level changes and sedimentation and accidental spillages.</p> <p>Indirect impacts during construction on Earham Park Wood LNR through the pollution of habitat from changes in air quality.</p>	<p>Pollution during construction will be mitigated by using best practice methods for pollution prevention and water management (Chapter 13. Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>. Monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP <b>(TR010037/APP/7.4)</b>.</p> <p>Where possible, construction vehicles should be excluded from driving over the Meadow Farm Meadows grassland. If this is not possible, heavy duty ground protection should be installed to protect the soil and turf.</p>
CWS (refer to section 8.7.6 and Table 8-5)	<p>Direct impact on Meadow Farm Meadows (east) CWS through temporary habitat loss.</p> <p>Potential of indirect impacts upon all CWSs from pollution of habitat from air quality and surface water runoff, water level changes, sedimentation and accidental spillages</p>	<p>No new drainage will be inserted into the CWS, and any road runoff should be directed away from the CWS. This has been included in the preliminary design and the ditch to east of A47 will be curtailed prior to CWS and will be replaced with a pipe to outfall at Cantley Stream.</p> <p>Where the 6m trench is to be dug through the CWS as part of the installation of UKPN electric cable the turf and sub soil must be used in the backfilling to maintain the pre-existing seedbank. Turf strips shall be removed first and stored in situ, and spoil will be stored in-situ on a tarpaulin and banded to prevent it washing into nearby watercourses. This process will be detailed in the EMP <b>(TR010037/APP/7.4)</b>.</p>

Ecological receptor	Description of impact (Construction)	Mitigation
<p>NERC Act (2006) priority habitats present within study area include lowland fens, arable field margins, traditional orchards, rivers, hedgerows, coastal and floodplain grazing marsh, standing water (ponds), lowland mixed deciduous woodland, wood pasture and parkland and lowland meadows.</p>	<p>Permanent loss of hedgerows, lowland meadows, and deciduous woodland. Indirect effects on lowland Fens, arable field margins, coastal and floodplain grazing marsh, ponds, rivers, deciduous woodland and hedgerows from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages</p> <p>No direct or indirect impacts predicted upon traditional orchards due to the distance from the works area, woodland pasture and parkland.</p>	<p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>The 5m section of species rich or 'important' hedgerow to be removed will be translocated and not lost. Species poor hedgerows will be gap filled to increase species diversity and quality across the site. New species rich hedgerows with trees will be planted in addition to deciduous woodland and parkland trees. Meadow grassland will be replanted.</p> <p>Pollution during construction will be mitigated by using best practice methods for pollution prevention and water management (Chapter 13. Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>. Monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP<b>(TR010037/APP/7.4)</b>.</p>
<p>Scattered mature and veteran trees</p>	<p>Two veteran trees will be removed. Impacts will be permanent and direct. Those to be retained, impacts will be indirect from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages</p>	<p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>Areas of land clearance will be replanted with native trees.</p> <p>Pollution prevention will be mitigated as in receptor above and 13: Road Drainage and Water Environment <b>(TR010037/APP/6.1)</b>.</p>
<p>Norfolk BAP Priority Habitats present include cereal field margin, hedgerows, lowland wood pasture and parkland, mixed deciduous woodland</p>	<p>Permanent loss of hedgerows and deciduous woodland.</p> <p>No direct impacts on lowland wood pasture and parkland and cereal field margins. indirect impacts from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages</p>	<p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>The small 5m section of species rich or 'important' hedgerow will be translocated and not lost. Species poor hedgerows will be gap filled to increase species diversity and quality across the site. New species rich hedgerows with trees will be planted in addition to deciduous woodland and parkland trees.</p> <p>Pollution prevention will be mitigated as in receptor above and 13: Road Drainage and Water Environment <b>(TR010037/APP/6.1)</b>.</p>
<p>Botanical</p>	<p>Direct impacts include loss of the botany within the Meadow Farm Meadow and old woodland and through the adjustment of the drainage ditches leading to water level change.</p>	<p>Pollution during construction will be mitigated by using best practice methods for pollution prevention and water management (Chapter 13. Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>. Surface water monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP<b>(TR010037/APP/7.4)</b>.</p> <p>Where possible construction vehicles should be excluded from driving over the Meadow Farm Meadows grassland. If this is not possible, heavy</p>

Ecological receptor	Description of impact (Construction)	Mitigation
		<p>duty ground protection should be installed to protect the soil and turf.</p> <p>No new drainage will be inserted into the CWS, and any road runoff should be directed away from the CWS. This has been included in the preliminary design and the ditch to east of A47 will be curtailed prior to CWS and will be replaced with a pipe to outfall at Cantley Stream.</p> <p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>Areas of land clearance will be replanted with appropriate new habitats including native trees and meadow planting as set out in the environmental masterplan(<b>TR010037/APP/6.8</b>).</p>
Terrestrial invertebrate	<p>Removal of habitat (permanent) and the risk of population decline through habitat fragmentation.</p> <p>Habitat degradation through pollution events from dust and accidental spills. Disturbance from light pollution.</p>	<p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>Pollution during construction will be mitigated by using best practice methods for pollution prevention and water management (Chapter 13. Road Drainage and Water Environment) (<b>TR010037/APP/6.1</b>). Surface water monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP (<b>TR010037/APP/7.4</b>).</p> <p>Night lighting during construction will be directed away from sensitive features and should not affect these species.</p> <p>Species rich grassland and woodland habitat will be provided as part of the landscape design which will mitigate the loss of existing habitat.</p> <p>All veteran trees to be retained shall be protected with a suitable buffer zone.</p>
Aquatic invertebrate	<p>Removal of habitat (permanent).</p> <p>Pollution risk of mortality of individuals from dust and accidental spills and changes to water levels and habitat suitability for common aquatic invertebrates.</p> <p>Disturbance from light pollution (temporary).</p>	<p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>Pollution during construction will be mitigated using best practice methods for pollution prevention and water management (Chapter 13 Road Drainage and Water Environment) (<b>TR010037/APP/6.1</b>). Surface water monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP.</p> <p>Night lighting during construction will be directed away from sensitive features and should not affect this species group.</p> <p>The installation of attenuation ponds and improved planting in Cantley Stream as part of the drainage design will mitigate for loss of habitat</p>



Ecological receptor	Description of impact (Construction)	Mitigation
Great crested newt (if found in remaining surveys to be completed)	Direct mortality of individuals during vegetation clearance and from collisions with construction traffic, entrapment in excavations, disturbance of places of shelter leading to abandonment. Loss of supporting and breeding habitat.	<p>If this species is found present within 500m of the scheme in the remaining surveys (that could not be completed due to covid-19), then works would need to be undertaken in those parts of the site affected under a Natural England mitigation licence. It would be necessary to find or create suitable receptor sites (either within DCO boundary or through landowner agreement) that include both breeding and terrestrial habitat. Newts would be removed from the area of works prior to commencement.</p> <p>Enhancement of the site to encourage this species back into the area includes the creation of tree lines, hedgerows, copses, species-rich grassland and an attenuation pond with associated wetland planting.</p> <p>These will be designed and reported in the REAC and the EMP (TR010037/APP/7.4).</p>
Reptile	<p>Direct mortality of individuals during vegetation clearance, collisions with construction traffic and entrapment in excavations.</p> <p>Disturbance of places of shelter leading to abandonment.</p> <p>Loss of supporting and breeding habitat.</p>	<p>Suitable habitats will be searched by an Ecological Clerk of Works prior to vegetation clearance. If any are found, they will be moved to a safe suitable area. Site clearance (excavation) will commence when reptiles are active during March to October inclusive.</p> <p>Tool-box talks will be given by the on-site ecological clerk of works (ECoW) to contractors.</p> <p>Areas of temporary land clearance will be replanted with native trees and shrubs and species-rich grassland.</p> <p>All excavations to be covered at night or a ramp left in so animals can climb out.</p>
Breeding birds	<p>Direct mortality of individuals from site clearance of vegetation during breeding season.</p> <p>Collisions with construction traffic.</p> <p>Disturbance of nesting locations from, noise and light pollution. Water pollution may also affect nesting and feeding for wildfowl species.</p> <p>Total loss of nesting habitats and foraging habitat across the scheme through vegetation clearance.</p> <p>Loss, degradation obstruction and disturbance of foraging and loafing habitat used by breeding birds from noise and light pollution leading to abandonment of area.</p>	<p>Reduction of as much permanent habitat loss as possible has been embedded in the design and where possible, habitat planting would be undertaken before the start of construction to minimise the intervening period between vegetation clearance and the establishment of the new habitat.</p> <p>Timing of vegetation clearance works is to take place outside of the bird nesting season. If it goes into nesting season, the areas to be cleared will be checked by an Ecological Clerk of Works immediately prior to clearance. Any nests or young would be avoided until the birds have fledged.</p> <p>Areas of temporary land clearance will be remediated with native trees and shrubs and species-rich grassland. Bird boxes will be installed on remaining trees at a density of between 10 and 40 nest boxes per hectare</p> <p>Gaps created in hedgerows will be infilled where possible and additional hedgerow, woodland, scrub</p>



Ecological receptor	Description of impact (Construction)	Mitigation
Wintering birds	<p>Direct mortality of individuals from site clearance of vegetation. Collisions with construction traffic.</p> <p>Disturbance of foraging and loafing locations from, noise and light pollution.</p> <p>Loss, obstruction and disturbance of key foraging and loafing habitat such as cereal crop and wintering crops leading to abandonment of area.</p>	<p>habitat will be included in the landscape plans to help mitigate the loss of suitable habitat.</p> <p>Disturbance from noise will be mitigated by use of temporary noise barriers, quieter plant, leaving a buffer zone around sensitive receptors and reducing time on noisy activities. Real-time noise monitoring shall be provided on sites where there are sensitive ecological receptors. Vibration will be reduced with early warning, pre-condition surveys, short work durations, and vibration monitoring. (Chapter 11, Noise and vibration) <b>(TR010037/APP/6.1)</b>.</p> <p>Night lighting during construction will be directed away from sensitive features and should not affect these species.</p> <p>Pollution during construction will be mitigated using best practice methods for pollution prevention and water management (Chapter 13. Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>. Surface water monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP <b>(TR010037/APP/7.4)</b>.</p> <p>Installation of bird nest boxes suitable for tit species, kestrel, sparrowhawk, barn owl, tawny owl and little owl should be installed in suitably retained habitat which will help mitigate the loss of existing habitat.</p> <p>Creation of kingfisher nesting banks at each of the proposed drainage basins and two mallard nest tubes will be installed at each drainage basin.</p>
Barn owl	<p>Direct mortality of individuals from site clearance of vegetation during breeding season,</p> <p>Disturbance of nesting locations from noise and light pollution.</p> <p>Loss of foraging habitat and suitable roosting habitat.</p>	<p>Disturbance from noise will be mitigated using temporary noise barriers, quieter plant, leaving a buffer zone around sensitive receptors and reducing time on noisy activities. Real-time noise monitoring shall be provided on sites where there are sensitive ecological receptors. Vibration will be reduced with early warning, pre-condition surveys, short work durations, and vibration monitoring. (Chapter 11. Noise and vibration) <b>(TR010037/APP/6.1)</b>.</p> <p>Night lighting during construction will be directed away from sensitive features and should not affect these species.</p> <p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>Creation of areas of rough grassland where possible as part of the landscape plans to mitigate the loss of suitable habitat. Installation of barn owl boxes close to suitable rough grassland will help in enhancing the area for the species.</p>
Bat	<p>Direct mortality through roost destruction during removal of tree roosts (permanent).</p> <p>Disturbance of known bat roosts</p>	<p>Disturbance and destruction of bat roosts to be fully mitigated as it requires a Natural England licence. This will include the installation of bat boxes on retained mature trees prior to enabling works.</p>

Ecological receptor	Description of impact (Construction)	Mitigation
	<p>from noise, vibration and light (temporary).</p> <p>Permanent loss of foraging habitat, severance of commuting routes and foraging areas, resulting in avoidance and abandonment of habitats and roosts.</p>	<p>Works close to roosts will be undertaken under supervision from a bat licence holder registered with Natural England.</p> <p>Disturbance from noise and vibration will be mitigated by deployment of temporary noise barriers, quieter plant and reducing time on noisy activities. (Chapter 11 Noise and Vibration) <b>(TR010037/APP/6.1)</b>.</p> <p>Night lighting during construction will be directed away from sensitive features and should not affect this species.</p> <p>Habitat loss and severance from the larger footprint of the Proposed Scheme cannot be mitigated at the start of construction. It will be compensated for as each phase of the works is completed with increased and enhanced tree planting and fencing along the east of the A11 - A47 connector road as a remediation measure and included in the Environmental Masterplan <b>(TR010037/APP/6.8)</b>.</p> <p>The addition of a 3m high environmental barrier between the existing A47 and the proposed A11-A47 slip road will help maintain the current higher bat flight path over the slip road and encourage bats to fly above traffic reducing potential for road casualties. Furthermore, the retaining of trees at the end of Cantley Lane (east of the DCO boundary) will extend the crossing point.</p>
Otter	<p>Direct mortality or injury of individuals from construction traffic and being trapped in excavations.</p> <p>Pollution risk of mortality of individuals from dust pollution, accidental spills and changes to habitat suitability from sedimentation and water level changes.</p> <p>Disturbance from noise and light pollution leading to abandonment of foraging areas and resting places (temporary).</p>	<p>Construction areas to be fenced off and all excavations to be covered at night or a ramp left in so animals can climb out.</p> <p>Pollution during construction will be mitigated using best practice methods for pollution prevention and water management (Chapter 13. Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>. Surface water monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP.</p> <p>Disturbance from noise will be mitigated by use of temporary noise barriers, quieter plant, leaving a buffer zone around sensitive receptors and reducing time on noisy activities. Real-time noise monitoring shall be provided on sites where there as sensitive ecological receptors. Vibration will be reduced with early warning, pre-condition surveys, short work durations, and vibration monitoring. (Chapter 11. Noise and vibration) <b>(TR010037/APP/6.1)</b>.</p> <p>Night lighting during construction will be directed away from sensitive features and should not affect these species.</p>
Water vole	<p>Direct mortality of individuals during vegetation clearance, stream dredging and realignment and collisions from</p>	<p>Water voles are present on Cantley Stream which is to be realigned. A water vole licence from Natural England will be needed to translocate these animals prior to these works. Mitigation will include</p>

Ecological receptor	Description of impact (Construction)	Mitigation
	<p>construction traffic, and loss of habitat in fenland area.</p> <p>This population will incur a risk of mortality of individuals from dust pollution, accidental spills and changes to habitat suitability from sedimentation and water level changes.</p> <p>Disturbance from noise and light pollution (temporary).</p>	<p>enhancing receptor areas further downstream and the new realigned stream with riparian planting suitable for cover and forage.</p> <p>Pollution during construction will be mitigated by using best practice methods for pollution prevention and water management (Chapter 13. Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>. Surface water monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP <b>(TR010037/APP/7.4)</b>.</p> <p>Disturbance from noise will be mitigated by use of temporary noise barriers, quieter plant, leaving a buffer zone around sensitive receptors and reducing time on noisy activities. Real-time noise monitoring shall be provided on sites where there as sensitive ecological receptors. Vibration will be reduced with early warning, pre-condition surveys, short work durations, and vibration monitoring. (Chapter 11 Noise and vibration) <b>(TR010037/APP/6.1)</b>.</p> <p>Night lighting during construction will be directed away from sensitive features and should not affect these species.</p>
Badger	<p>Permanent loss of potential commuting and foraging habitat from badgers in setts close to works but not within physical disturbance range.</p> <p>Disturbance from noise and light levels.</p> <p>Potential of death or injury of individuals from falling in excavations.</p>	<p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>Disturbance from noise will be mitigated by use of temporary noise barriers, quieter plant, leaving a buffer zone around sensitive receptors and reducing time on noisy activities. Real-time noise monitoring shall be provided on sites where there as sensitive ecological receptors. Vibration will be reduced with early warning, pre-condition surveys, short work durations, and vibration monitoring. (Chapter 11 Noise and vibration) <b>(TR010037/APP/6.1)</b>.</p> <p>Night lighting during construction will be directed away from sensitive features and should not affect this species.</p> <p>All excavations to be covered at night or a ramp left in so animals can climb out.</p>
Invasive species	<p>Introduction and spread of diseases during construction could result in death of plants and animals (examples: Ash dieback, ranavirus) (permanent). Introduction and assisted spread of invasive species during construction may result in squeezing out of native habitats and species. (temporary)</p>	<p>The spread of INNS during construction will be mitigated by implementation of an INNS Management Plan. This will contain details of appropriate treatment methods to ensure that construction proceeds within the legal framework to ensure prevention of spread both within and beyond the site boundaries. The INNS plan will also cover animal biosecurity if necessary.</p> <p>The transfer of diseases during construction will be mitigated by implementation of a Biosecurity Management Plan, which will also be reported in the REAC and the EMP <b>(TR010037/APP/7.4)</b>.</p>

Ecological receptor	Description of impact (Construction)	Mitigation
Other notable species (Common toad, hedgehog and fish species)	<p>Permanent loss of commuting routes and areas of shelter and foraging.</p> <p>Direct mortality of individuals from collisions with construction traffic, entrapment in excavations.</p> <p>Disturbance from noise and light pollution of places of shelter leading to abandonment.</p> <p>Risk of mortality of individuals from dust pollution, accidental spills and changes to habitat suitability from sedimentation and water level changes</p> <p>Direct mortality of fish species during in stream works</p>	<p>Reduction of as much permanent habitat loss as possible has been embedded in the design.</p> <p>Suitable habitats will be searched by an Ecological Clerk of Works prior to vegetation clearance. If any of these species are found they will be moved to a safe suitable area.</p> <p>Areas of land clearance will be replanted with native trees and shrubs and species-rich grassland.</p> <p>All excavations to be covered at night or a ramp left in so animals can climb out.</p> <p>Pollution during construction will be mitigated by using best practice methods for pollution prevention and water management (Chapter 13. Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>. Monitoring during construction will also be implemented and will be outlined within the temporary surface water drainage strategy within the EMP.</p> <p>Where works are to be undertaken in water, an ECoW will be present to check for fish. If fish are detected, a fish rescue will be required prior to instream works. This has been detailed within the EMP <b>(TR010037/APP/7.4)</b>.</p>

Table 8-10 Ecological design and mitigation measures (Operational)

Ecological receptor	Description of impact (Operation)	Mitigation
Eaton Chalk Pit SSSI	No impacts.	None required
Eaton Common, Earlham Park Woods and Marston Marshes LNR	<p>No direct impacts.</p> <p>Indirect impacts during operation from surface water run-off, sedimentation, water level changes and air quality.</p>	Appropriate drainage system in place including vegetated attenuation ponds to treat run off. (Chapter 13: Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b> .
CWS (refer to section 8.7.6 and Table 8-5)	<p>Direct impacts during operation on Meadow Farm Meadows through water level change, surface water run-off and pollution gradually degrading habitats</p> <p>Indirect impacts during operation from surface water run-off, sedimentation, water level changes, air pollution gradually degrading habitats.</p>	Appropriate drainage system in place including vegetated attenuation ponds to treat run off. (Chapter 13: Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b> .
NERC Act (2006) priority habitats present within study area include lowland fens, arable field margins, traditional orchards,	No direct or indirect impacts predicted upon traditional orchards due to the distance from the works area,	None required.

Ecological receptor	Description of impact (Operation)	Mitigation
rivers, hedgerows, coastal and floodplain grazing marsh, standing water (ponds), lowland mixed deciduous woodland, wood pasture and parkland and lowland meadows.	woodland pasture and parkland.  Indirect impacts upon all other habitats during operation from surface water run-off, sedimentation, water level changes, air pollution gradually degrading habitats.	
Scattered mature and veteran trees	Trees remaining - impacts will be indirect from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages	Appropriate drainage system in place including vegetated attenuation ponds to treat run off. (Chapter 13: Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b> .
Norfolk BAP Priority Habitats present include cereal field margin, hedgerows, lowland wood pasture and parkland, mixed deciduous woodland	Indirect impacts upon hedgerows and deciduous woodland through the pollution of habitats from air quality and surface water runoff, sedimentation, water level changes and air pollution gradually degrading habitats.	
Botanical	Indirect impacts upon on botanical composition during operation from surface water run-off, sedimentation, water level changes, air pollution gradually degrading habitats.	
Terrestrial invertebrates	Reduction in abundance due to the presence of a physical barrier which will reduce dispersal of species.  Potential risk of mortality of individuals through pollution from air quality and surface water runoff, sedimentation, water level changes and habitat suitability for common terrestrial invertebrates.  Disturbance from light pollution (permanent).	Appropriate drainage system in place including vegetated attenuation ponds to treat run off. (Chapter 13: Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b> .  Light spill will increase around Thickthorn Junction and the overbridges. Woodland planting has been included in the environmental masterplan to reduce the effects of permanent lighting on sensitive ecological receptors.
Aquatic invertebrates	Potential risk of mortality of individuals from pollution from air quality and surface water runoff, sedimentation, water level changes and habitat suitability for common aquatic invertebrates.  Disturbance from light pollution (permanent).	Lighting will be designed with backlight shields and LED bulbs to reduce light spill onto habitats.

Ecological receptor	Description of impact (Operation)	Mitigation
Great crested newt (if found in remaining surveys to be completed)	Pollution of breeding ponds from surface water run-off carrying contaminants and pollutants due to increased area of hard-standing. Loss of terrestrial habitat. Changes to habitat suitability through pollution.	The management of created habitat (if required) will be detailed in the EMP <b>(TR010037/APP/7.4)</b> .  Population to be monitored during operation and if required, changes to the EMP can be made.
Reptile	Reduction in abundance due to the presence of a physical barrier which will reduce dispersal of species.  Changes to habitat suitability for reptiles through air pollution and surface water run-off.	Appropriate drainage system in place including vegetated attenuation ponds to treat run off. (Chapter 13: Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b> .  Reptile enhancement will be undertaken behind Cantley Lane area consisting of the installation of reptile hibernacula, hummock landscaping and planting of scrub and rough grassy areas.
Breeding birds	Direct mortality of individuals through traffic collisions due to wider junction and road.  Disturbance of nesting locations from noise and light pollution. Water pollution may also affect nesting and feeding for wildfowl species.  Degradation of habitat and obstruction and disturbance of foraging and loafing on individuals from water and light pollution leading to abandonment of area.	Light spill will increase around Thickthorn Junction and the overbridges. Woodland planting has been included in the environmental masterplan to reduce the effects of permanent lighting in these areas. Lighting will be designed with backlight shields and LED bulbs to reduce light spill onto habitats.  Appropriate drainage system in place including vegetated attenuation ponds to treat run off. (Chapter 13: Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b> .
Wintering birds	Direct mortality of individuals through traffic collisions due to wider junction and road.  Disturbance of foraging and loafing locations from noise and light pollution.  Degradation of habitat and the obstruction and disturbance of foraging and loafing areas from water and light pollution leading to abandonment of area.	Bat crossing point section and woodland and tree planting will assist birds in flying high over the A47. Nutrient poor habitats adjacent to the roads will help reduce the amount of scrub which will reduce foraging habitat on roadsides, results in a potential decrease in road casualties.
Barn owl	Disturbance of nesting locations from noise and light pollution.  Potential increase in mortality from increased road traffic collisions.  Loss, obstruction and disturbance of foraging habitat of breeding individuals from noise and	Light spill will increase around Thickthorn Junction and overbridges. Woodland planting has been included in the environmental masterplan to reduce the effects of permanent lighting in these areas. Lighting will be designed with backlight shields and LED bulbs to reduce light spill onto habitats.  To minimise risk of mortality to barn owls, new habitat in the form of hedgerows, scattered broadleaved trees to include individual 'parkland'



Ecological receptor	Description of impact (Operation)	Mitigation
	light pollution leading to abandonment of area.	trees adjacent and species-rich grassland will be provided on both sides of the Cantley Link Road and main A47. This planting will aid the visual screening of the Cantley Lane link road and in addition will provide a safer road crossing option for barn owls
Bat	<p>Direct mortality of individuals due to traffic collisions caused by road widening.</p> <p>Pollution of water courses and degradation of habitats could lead to reduction in prey availability</p> <p>Disturbance for noise, vibration or light spill resulting in permanent avoidance and abandonment of foraging habitats, commuting routes and roosts.</p>	<p>Habitat loss and severance from the larger footprint of the new Cantley Lane link road and A11-A47 Connector Road will be compensated for as each phase of the road is completed with increased and enhanced tree planting along the east of the A11 - A47 link road as a remediation measure for the bats that cross there.</p> <p>Light spill will increase around Thickthorn Junction and overbridges. Woodland planting has been included in the environmental masterplan to reduce the effects of permanent lighting in these areas. Lighting will be designed with backlight shields and LED bulbs to reduce light spill onto habitats.</p> <p>Appropriate drainage system in place including vegetated attenuation ponds to treat run off (Chapter 13: Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>.</p>
Otter	<p>Direct mortality of individuals through traffic collisions due to wider junction and road.</p> <p>Potential risk of mortality of individuals from air pollution and surface water runoff, sedimentation, water level changes and decreased habitat suitability for otters.</p> <p>Disturbance from light pollution (permanent).</p>	<p>Appropriate drainage system in place including vegetated attenuation ponds to treat run off. (Chapter 13: Road Drainage and Water Environment) <b>(TR010037/APP/6.1)</b>.</p> <p>Light spill will increase around Thickthorn Junction and overbridges. Woodland planting has been included in the environmental masterplan to reduce the effects of permanent lighting in these areas. Lighting will be designed with backlight shields and LED bulbs to reduce light spill onto habitats which are used by otter and water vole.</p>
Water Vole	<p>Potential risk of mortality of individuals from air pollution, pollution through increase surface water runoff, sedimentation, water level changes and decreased habitat suitability for water voles.</p> <p>Disturbance from light pollution (permanent).</p>	<p>The culverts across the scheme will be designed with suitable ledges to enable otter to pass through and fenced to prevent otter crossing Cantley Lane.</p> <p>Habitat suitable for water voles will be increased in size as part of the Natural England mitigation licence.</p>
Badger	No direct impacts to setts. Potential flood events from the realigned Cantley stream and associated overflow areas.	Light spill will increase around Thickthorn Junction and overbridges. Woodland planting has been included in the environmental masterplan to reduce the effects of permanent lighting in these areas. Lighting will be designed



Ecological receptor	Description of impact (Operation)	Mitigation
	<p>Direct mortality of individuals through traffic collisions due to wider junction and new roads.</p> <p>Disturbance from noise and light levels.</p>	<p>with backlight shields and LED bulbs to reduce light spill onto habitats.</p>
Invasive species	No operational impacts anticipated	None
Other notable species (Common toad, hedgehog and fish species)	<p>Direct mortality of individuals through traffic collisions due to wider junction and road.</p> <p>Risk of mortality of individuals from air pollution, surface water runoff, sedimentation, water level changes and reduction in habitat suitability.</p> <p>Disturbance from light pollution (permanent).</p>	<p>New and continuous habitat provided on both sides of the road as a refuge.</p> <p>Lighting will be designed with backlight shields and LED bulbs to reduce light spill onto habitats.</p>

8.9.5. The type and area of habitat affected during construction is calculated below:

- Broadleaved Semi-Natural Woodland 1.9ha
- Broadleaved Plantation 8.0ha
- Coniferous Plantation 0.2ha
- Mixed Plantation Woodland 2.2ha
- Dense continuous scrub 0.3ha
- Scattered scrub 0.7ha
- Semi-improved neutral grassland 10.8ha
- Improved grassland 2.1ha
- Marsh/marshy grassland 0.05ha
- Poor semi-improved grassland 0.7ha
- Tall ruderal 2.3ha
- Standing water 0.03ha
- Arable 16.4ha
- Bare ground 0.3ha
- Scattered trees 44 no.

8.9.6. The types and areas of habitat creation and the increases or decreases in size of each habitat are provided in Table 8-11.

Table 8-11 Habitat types and areas to be remediated or enhanced

Habitat type	Habitat loss amount (ha)		Reinstatement or enhancement of habitat amount	Net gain or loss of habitat type
	Permanent Works	Temporary Works		
Broadleaved Semi-Natural Woodland	1.11	0	4ha	Net gain of 2.9ha
Broadleaved Plantation	3.06	0.13	0	Net loss of 3.19ha
Mixed Plantation Woodland	0.76	0.004	0	Net loss of 0.76ha
Dense continuous scrub	0.13	0	0.4ha	Net gain of 0.27ha
Scattered scrub	0.25	0	0	Net loss of 0.25ha
Semi-improved neutral grassland	3.7	3.13	16ha	Net gain of 9.17ha
Improved grassland	0.77	0	0	Net loss of 0.77ha
Poor semi-improved grassland	0.05	0	0	Net loss of 0.05ha
Tall ruderal	1.98	0	0	Net loss of 1.98ha
Arable	6.15	5.53	0	Net loss of 11.68ha
Bare ground	0.03	0	0	Net loss of 0.03ha
Scattered trees	20	10	102 trees	Net gain of 72 trees
Native Hedgerow	0	0	977m	Net gain of 977m
Native Hedgerow with trees	0	0	321m	Net gain of 321m

## 8.10. Assessment of likely significant residual effects

8.10.1. An assessment of the residual ecological effects predicted following the implementation of mitigation outlined within Table 8-9 and 8-10 is presented within Table 8-12.

Table 8-12 Predicted significance of residual effects on biodiversity resources following implementation of committed mitigation

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
Eaton Chalk Pit SSSI	National	<p><b>Construction</b></p> <p>Indirect impacts during construction through increase air pollution.</p>	Negligible adverse	Temporary	No residual impacts anticipated	No change	Neutral
		<p><b>Operation</b></p> <p>No direct or indirect impacts.</p>	No change	N/A	No residual impacts anticipated	No change	Neutral
Eaton Common, Earlham Park Woods and Marston Marshes LNR	Local	<p><b>Construction</b></p> <p>Direct impacts from pollution of habitat within Eaton Common and Marston Marshes LNR through surface water runoff, water level changes and sedimentation and accidental spillages.</p> <p>Indirect impacts during construction on Earlham Park Wood LNR through the pollution of habitat from changes in air quality.</p>	<p>Moderate adverse (Eaton Common and Marston Marshes)</p> <p>Negligible adverse (Earlham Park Woods)</p>	Temporary	Attenuation ponds will be created and planted with suitable vegetation to trap and reduce pollution into nearby water courses from overland run off events.	Negligible adverse	Neutral
		<p><b>Operation</b></p> <p>No direct impacts.</p> <p>Indirect impacts during operation from surface water run-off,</p>	Moderate adverse	Permanent	Attenuation ponds for infiltration will be designed as a sustainable urban drainage system (SuDS) feature to reduce run-off and filter the water from contaminants.	Negligible adverse	Neutral

<sup>5</sup> Temporary and permanent impacts are characterised by using knowledge of the nature of the impact of the works. Table 3.11 of LA 108 (Biodiversity) gives further descriptions used to aid this characterisation.

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
		sedimentation, water level changes.			Once the scheme is operational, there will be no significant effect from pollution and no further mitigation will be required.		
CWS (refer to section 8.7.6 and Table 8-5)	County	<p><b>Construction</b></p> <p>Direct impact on Meadow Farm Meadows (east) CWS through temporary habitat loss.</p> <p>Potential of indirect impacts upon all CWSs from pollution of habitat from air quality and surface water runoff, water level changes, sedimentation and accidental spillages.</p>	<p>Major adverse (Meadow Farm Meadows)</p> <p>Moderate adverse (Eaton Common,)</p> <p>Negligible adverse (all remaining)</p>	Temporary	<p>The lost area of meadow habitat will be mitigated for by the steps set out below.</p> <p>Where the 6m trench is to be dug through the CWS as part of the installation of UKPN electric cable the turf and sub soil must be used in the backfilling to maintain the pre-existing seedbank. Turf strips shall be removed first and stored in situ, and spoil will be stored in-situ on a tarpaulin and banded to prevent it washing into nearby watercourses. This process will be detailed in the EMP <b>(TR010037/APP/7.4)</b>.</p>	<p>Minor adverse (Meadow farm Meadow)</p> <p>No change (all other CWS)</p>	<p>Slight adverse (Meadow Farm Meadows)</p> <p>Neutral (all other CWS)</p>
		<p><b>Operation</b></p> <p>Direct impacts during operation on Meadow Farm Meadows through water level change, surface water run-off and pollution gradually degrading habitats</p> <p>Indirect impacts during operation from surface water run-off, sedimentation, water level changes, air pollution gradually degrading habitats.</p>	<p>Major adverse (Meadow Farm Meadows)</p> <p>Minor adverse (all other)</p>	Permanent	<p>The drainage ditch which runs adjacent to the CWS will be piped and will discharge directly into the outfall to remove risks associated with flooding the sensitive habitat of Meadow Farm Meadows CWS.</p> <p>No residual effects from pollution anticipated.</p> <p>For the reasons set out above, the significance of the residual effect on Meadow Farm</p>	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
					<p>Meadows has been set out at slight adverse.</p> <p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants.</p>		
<p>NERC Act (2006) priority habitats; lowland fens, arable field margins, traditional orchards, rivers, hedgerows, coastal and floodplain grazing marsh, standing water (ponds), lowland mixed deciduous woodland, wood pasture and parkland and</p>	National	<p><b>Construction</b></p> <p>Permanent loss of hedgerows, lowland meadows, and deciduous woodland.</p>	Major adverse	Permanent	<p>Compensatory species-rich hedgerow and native woodland planting is to be undertaken which matures slowly. The time lag will take years to reach its full former maturity causing residual effects.</p>	Moderate adverse (hedgerows, deciduous woodland)	<b>Moderate adverse (hedgerows, deciduous woodland)</b>
		<p>Indirect effects on lowland Fens, arable field margins, coastal and floodplain grazing marsh, ponds, rivers, deciduous woodland and hedgerows from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages</p>	Moderate adverse		<p>Compensatory increased areas of species-rich grassland planting is to be undertaken which matures quickly. This remediation will have beneficial residual effects</p>	Minor beneficial (lowland meadows)	Slight beneficial (lowland meadows)
		<p>No direct or indirect impacts predicted upon traditional orchards due to the distance from the works area, woodland pasture and parkland.</p>	No change		<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual effects from pollution anticipated.</p> <p>For the reasons set out above, the significance of the residual effect on hedgerows and deciduous woodland has been set out at moderate and not large</p>	No change (all other habitats)	Neutral (all other habitats)

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
lowland meadows.					and lowland meadows as slight over neutral.		
		<p><b>Operation</b></p> <p>Indirect impacts upon all other habitats during operation from surface water run-off, sedimentation, water level changes</p> <p>No direct or indirect impacts predicted upon traditional orchards due to the distance from the works area, woodland pasture and parkland.</p>	<p>Moderate adverse</p> <p>No change</p>	Permanent	<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants.</p> <p>No residual effects from pollution anticipated.</p>	No change	Neutral
Scattered mature and veteran trees	National	<p><b>Construction</b></p> <p>Two veteran trees will be removed. Impacts will be permanent and direct.</p> <p>Those to be retained, impacts will be indirect from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages.</p>	<p>Major adverse for removed trees.</p> <p>Moderate adverse for retained trees</p>	Permanent	<p>Tree planting to replace mature and veteran trees will take decades to achieve former maturity.</p> <p>For the reasons set out above, the significance of the residual effect has been set out at large not moderate.</p>	Moderate adverse	<b>Large adverse</b>
		<p><b>Operation</b></p> <p>Trees remaining - impacts will be indirect from pollution of habitat, surface water runoff, sedimentation and accidental spillages.</p>	Negligible adverse	Permanent	<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants.</p>	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
Norfolk BAP Priority Habitats present include cereal field margin, hedgerows, lowland wood pasture and parkland, mixed deciduous woodland	County	<p><b>Construction</b></p> <p>Permanent loss of hedgerows and deciduous woodland.</p> <p>No direct impacts on lowland wood pasture and parkland and cereal field margins. Anticipated to be indirect impacts from pollution of habitat, air quality, surface water runoff, sedimentation and accidental spillages.</p>	<p>Major adverse (hedgerows &amp; deciduous woodland)</p> <p>Moderate adverse (lowland wood pasture and cereal field margins)</p>	Permanent	<p>Species poor hedgerows will be gap filled to increase species diversity and quality across the site. New deciduous woodland will take a long time to reach former maturity.</p> <p>No residual impacts from pollution are anticipated and no mitigation will be required.</p>	<p>Moderate adverse (hedgerows and deciduous woodland)</p> <p>No change (all other habitats)</p>	<p>Slight adverse (hedgerows and deciduous woodland)</p> <p>Neutral (all other habitats)</p>
		<p><b>Operation</b></p> <p>Indirect impacts upon hedgerows and deciduous woodland through the pollution of habitats from surface water runoff, sedimentation, water level changes and pollution gradually degrading habitats.</p>	Moderate adverse	Permanent	<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual impacts from pollution are anticipated and no mitigation will be required.</p>	No change	Neutral
Botanical	Local	<p><b>Construction</b></p> <p>Direct impacts include loss of the botany within the Meadow Farm Meadow and old woodland habitat and through the adjustment of the drainage ditches leading to water level change.</p>	Major adverse	Permanent	<p>Species-rich grassland will be included across the scheme as part of the landscape planning. In addition, the reduction in use of nutrient rich topsoil will enable a more diverse botanical population to colonise newly created bare ground. Meadow planting will reach maturity quickly.</p>	<p>Minor beneficial (botany of Meadow Farm Meadow)</p> <p>Moderate adverse (old woodland planting)</p>	<p>Neutral (botany of Meadow Farm Meadow)</p> <p>Slight adverse (old woodland planting)</p>



Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
					<p>New deciduous woodland will take a long time to reach former maturity.</p> <p>No residual effects from pollution are anticipated.</p> <p>For the reasons set out above, the significance of the residual effect has been set out at neutral not slight for Meadow Farm Meadows and slight not neutral for old woodland planting.</p>		
		<p><b><u>Operation</u></b></p> <p>Indirect impacts upon on botanical composition during operation from surface water run-off, sedimentation, water level changes, pollution gradually degrading habitats.</p>	Moderate adverse	Permanent	<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual effects from pollution are anticipated.</p>	No change	Neutral (botany of Meadow Farm Meadow)
Terrestrial Invertebrate	Local	<p><b><u>Construction</u></b></p> <p>Removal of habitat (permanent). Risk of population decline through habitat fragmentation. Habitat degradation through pollution events from dust and accidental spills. Disturbance from light pollution.</p>	Minor adverse	Permanent (habitat removal) and temporary (light pollution).	<p>Compensatory planting is included in the landscape design.</p> <p>Any mature trees which are to be removed will be constructed into habitat piles to continue to provide suitable habitat for invertebrates.</p> <p>Most invertebrates will benefit from other habitat planting and enhancement</p> <p>No residual effects anticipated from pollution.</p>	Minor adverse	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
					For the reasons set out above, the significance of the residual effect has been set out at neutral not slight.		
		<p><b>Operation</b></p> <p>Reduction in abundance due to the presence of a physical barrier which will reduce dispersal of species.</p> <p>Potential risk of mortality of individuals through pollution from surface water runoff, sedimentation, water level changes and habitat suitability for common aquatic invertebrates.</p> <p>Disturbance from light pollution.</p>	Minor adverse	Permanent	<p>Most invertebrates will benefit from other habitat planting and enhancement</p> <p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual effects anticipated from pollution.</p>	No change	Neutral
Aquatic invertebrates	Local	<p><b>Construction</b></p> <p>Removal of habitat. Pollution risk of mortality of individuals from dust and accidental spills and changes to water levels and habitat suitability for common aquatic invertebrates.</p> <p>Disturbance from light pollution.</p>	Minor adverse	Permanent (habitat removal) and temporary (light pollution).	<p>Cantley Stream planting and attenuation ponds will be vegetated to help increase habitat for these species. The habitat will mature quickly.</p> <p>For the reasons set out above, the significance of the residual effect has been set out at neutral not slight.</p>	Minor beneficial	Neutral
		<p><b>Operation</b></p> <p>Potential risk of mortality of individuals from pollution from air quality and surface water runoff, sedimentation, water level</p>	Minor adverse	Permanent	<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants.</p>	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
		changes and habitat suitability for common aquatic invertebrates. Disturbance from light pollution.			No residual effects from pollution are anticipated.		
Great crested newt (if found in remaining surveys to be completed)	County	<p><b>Construction</b></p> <p>Direct mortality of individuals during vegetation clearance and from collisions with construction traffic, entrapment in excavations, disturbance of places of shelter leading to abandonment. Loss of supporting and breeding habitat.</p>	Major adverse	Permanent	<p>Direct mortality would be avoided by mitigation. If this species found present, suitable breeding and terrestrial habitats would be enhanced and increased under licence either within DCO boundary or through landowner agreement. No change in population is predicted.</p> <p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual effects from pollution anticipated.</p>	No change	Neutral
		<p><b>Operation</b></p> <p>Pollution of breeding ponds from surface water run-off carrying contaminants and pollutants due to increased area of hard standing. Loss of terrestrial habitat. Changes to habitat suitability through pollution.</p>	Minor adverse	Permanent	<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual effects from pollution anticipated.</p>	No change	Neutral
Reptile	County	<p><b>Construction</b></p> <p>Direct mortality of individuals during vegetation clearance and from collisions with construction traffic, entrapment in excavations,</p>	Minor adverse	Permanent	<p>Direct mortality would be avoided by on site mitigation such as covered working trenches and the presence of an ECoW. Suitable grassland and scrub</p>	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
		disturbance of places of shelter leading to abandonment. Loss of supporting and breeding habitat.			habitats and hibernacula to be remediated would not take long to mature.  No change in population is predicted.		
		<p><b>Operation</b></p> <p>Reduction in abundance due to the presence of a physical barrier which will reduce dispersal of species.</p> <p>Changes to habitat suitability for reptiles through pollution and surface water run-off.</p>	Minor adverse	Permanent	<p>No change in population is predicted.</p> <p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual effects from pollution anticipated.</p>	No change	Neutral
Breeding birds	Local	<p><b>Construction</b></p> <p>Direct mortality of individuals from site clearance of vegetation during breeding season, disturbance of nesting locations from water, noise and light pollution. Collisions with construction traffic.</p> <p>Loss, obstruction and disturbance of foraging and loafing habitat of breeding individuals from the fishing lake, streams and river, noise and light pollution leading to abandonment of area.</p>	Minor adverse	Permanent	<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual effects anticipated from pollution.</p> <p>For the reasons set out above, the significance of the residual effect has been set out at neutral not slight.</p>	No change	Neutral
		<p><b>Operation</b></p>	Minor adverse	Permanent	<p>Areas of suitable habitat for breeding birds will be compensated for in the</p>	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
		<p>Direct mortality of individuals through traffic collisions due to wider junction and road.</p> <p>Disturbance of nesting locations from noise and light pollution. Water pollution may also affect nesting and feeding for wildfowl species.</p> <p>Degradation of habitat and obstruction and disturbance of foraging and loafing on individuals from water and light pollution leading to abandonment of area.</p>			<p>landscape design. The installation of nest boxes will mitigate for the loss of nesting sites and will provide additional nesting opportunity during the operational phase whilst the landscape planting is establishing.</p> <p>Although woodland planting will take many years to reach the maturity of the existing woodland, there is suitable quantities of surrounding woodland to enable birds to remain in the area whilst the newly planting woodland are establishing.</p> <p>Nutrient poor habitats adjacent to the roads will help reduce the amount of scrub which will reduce foraging habitat on roadsides, results in a potential decrease in road casualties. Additionally, planting for bat crossing points creates areas of increased vegetation height which will assist birds in maintaining a high fly path across the road.</p> <p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual effects anticipated from pollution.</p>		

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
					For the reasons set out above, the significance of the residual effect has been set out at neutral not slight.		
Wintering bird	Local	<p><b>Construction</b></p> <p>Direct mortality of individuals from site clearance of vegetation, disturbance of foraging and loafing locations from fishing lake, river and streams, noise and light pollution. Collisions with construction traffic.</p> <p>Loss, obstruction and disturbance of key foraging and loafing habitat such as cereal crop and wintering crops leading to abandonment of area.</p>	Minor adverse	Temporary (collisions with construction traffic) and permanent (habitat loss).	There is no change anticipated after mitigation to wintering birds and no residual impacts from pollution.	Minor adverse	Neutral
		<p><b>Operation</b></p> <p>Direct mortality of individuals through traffic collisions due to wider junction and road.</p> <p>Disturbance of foraging and loafing locations from noise and light pollution.</p> <p>Degradation of habitat and the obstruction and disturbance of foraging and loafing areas from water and light pollution leading to abandonment of area.</p>	Minor adverse	Permanent	<p>Within the landscape design this includes berry bearing trees and scrubs except on areas near the A47 where low nutrient planting will be undertaken</p> <p>Planting for bat crossing points creates areas of increase vegetation height which will assist birds in maintaining a high fly path across the road.</p> <p>Although woodland planting will take several years to reach the maturity of the existing woodland, there is suitable quantities of surrounding</p>	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
					<p>woodland to enable birds to remain in the area whilst the newly planting woodland are establishing.</p> <p>There is no change anticipated after mitigation to wintering birds and no residual impacts from pollution.</p> <p>For the reasons set out above, the significance of the residual effect has been set out at neutral not slight.</p>		
Barn owl	County	<p><b>Construction</b></p> <p>Direct mortality of individuals from site clearance of vegetation during breeding season, disturbance of nesting locations from noise and light pollution.</p> <p>Loss of foraging habitat and suitable roosting habitat.</p>	Major adverse	Temporary	<p>No direct impacts on known nesting sites will occur throughout the proposed works. Where suitable rough grassland areas will be lost during the construction, this will be compensated for in the landscape design.</p>	Moderate adverse	Slight adverse
		<p><b>Operation</b></p> <p>Disturbance of nesting locations from noise and light pollution. Mortality from the increased potential for collisions with traffic.</p> <p>Loss, obstruction and disturbance of foraging habitat of breeding individuals from noise and light pollution leading to abandonment of area.</p>	Major Adverse	Permanent	<p>The landscape plan will also encourage tall trees alongside the new Cantley Link road to act as a 'fly over' to encourage birds to fly high enough over the new road to avoid traffic collisions. Habitat planting along the existing A47 will include tall trees to help encourage birds to fly higher. However, this will take time to mature.</p>	Moderate adverse	Slight adverse



Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
					<p>Nest boxes will be installed in suitable habitat to help enhance breeding opportunities across the site.</p> <p>No residual impacts from pollution are anticipated.</p>		
Bat	County	<p><b>Construction</b></p> <p>Direct mortality through roost destruction during removal of tree roosts (permanent). Disturbance of known bat roosts from noise, vibration and light (temporary).</p> <p>Permanent loss of foraging habitat, severance of commuting routes and foraging areas, resulting in avoidance and abandonment of habitats and roosts.</p>	Major Adverse	Permanent	<p>After mitigation included in the Natural England mitigation licence method statement, residual effects to roosts will be neutral.</p> <p>Disturbance from loss of habitat during construction will not be remediated immediately as there will be a time lag between loss and the remediated habitats reaching maturity.</p> <p>Disturbance from noise, vibration and light spill is not predicted to cause residual effects.</p>	Moderate adverse	Slight adverse
		<p><b>Operation</b></p> <p>Direct mortality of individuals due to traffic collisions caused by road widening.</p> <p>Pollution of water courses and degradation of habitats could lead to reduction in prey availability</p> <p>Disturbance for noise, vibration or light spill resulting in permanent avoidance and abandonment of</p>	Major adverse	Permanent	<p>Disturbance from noise, vibration and light spill is not predicted to cause residual effects.</p> <p>Mortality through traffic collisions is predicted to be less likely once remediated road-side trees mature. The addition of a 3m high environmental barrier to create a bat crossing point between the existing A47 and the proposed new slip road will help maintain the current higher bat</p>	Moderate adverse	Slight adverse

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
		foraging habitats, commuting routes and roosts.			flight path over the slip road and encourage bats to fly above traffic reducing road casualties.		
Otter	County	<p><b>Construction</b></p> <p>Direct mortality or injury of individuals from construction traffic and being trapped in excavations.</p> <p>Pollution risk of mortality of individuals from dust and accidental spills and changes to habitat suitability from sedimentation and water level changes. Disturbance from noise and light pollution leading to abandonment of foraging areas and resting places (temporary).</p>	Major adverse	Temporary	<p>If a holt is found to be present during pre-construction surveys, mitigation would be included in a Natural England mitigation licence method statement, that would bring residual effects to otter holts to be neutral.</p> <p>Direct mortality would be avoided by fencing Cantley Stream culvert.</p>	No change	Neutral
		<p><b>Operation</b></p> <p>Direct mortality of individuals through traffic collisions due to wider junction and road.</p> <p>Potential risk of mortality of individuals from surface water runoff, sedimentation, water level changes and decreased habitat suitability for otters.</p> <p>Disturbance from light pollution.</p>	Major Adverse	Permanent	<p>Direct mortality would be avoided by fencing Cantley Stream culvert.</p> <p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual impacts from pollution anticipated</p>	No change	Neutral
Water vole	County	<p><b>Construction</b></p>	Major adverse	Permanent (habitat removal) and	After mitigation included in the Natural England mitigation licence method statement,	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
		<p>Direct mortality of individuals during vegetation clearance, stream dredging and realignment and collisions from construction traffic, and loss of habitat in fenland area.</p> <p>This population will incur a pollution risk of mortality of individuals from dust and accidental spills and changes to habitat suitability from sedimentation and water level changes. Disturbance from noise and light pollution .</p>		temporary (light disturbance)	<p>residual impacts to water voles will be neutral.</p> <p>No residual impacts from pollution anticipated.</p>		
		<p><b>Operation</b></p> <p>Potential risk of mortality of individuals from pollution through increase surface water runoff, sedimentation, water level changes and decreased habitat suitability for water voles.</p> <p>Avoidance and abandonment of burrows due to new culvert and stream realignment.</p> <p>Disturbance from light pollution.</p>	Major Adverse	Permanent	<p>Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants. No residual impacts from pollution anticipated.</p>	No change	Neutral
Badger	Local (legal constraints apply)	<p><b>Construction</b></p> <p>Permanent loss of potential commuting and foraging habitat from badgers in setts close to works but not within physical disturbance range.</p>	Minor adverse	Permanent	<p>It is not considered that the effects of mortality to mammals will be at a level that would be greater than at present and would not justify the installation of badger tunnels.</p>	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
		Disturbance from noise and light levels. Potential of death or injury of individuals from falling in excavations.					
		<p><b>Operation</b></p> <p>No direct impacts to setts. Potential flood events from the realigned Cantley stream and associated overflow areas.</p> <p>Direct mortality of individuals through traffic collisions due to wider junction and new roads.</p> <p>Disturbance from noise and light levels.</p>	Minor Adverse	Permanent	<p>It is not considered that the effects of mortality to mammals will be at a level that would be greater than at present and would not justify the installation of badger tunnels.</p> <p>No further residual effects from pollution anticipated.</p>	No change	Neutral
Invasive	Negligible (legal constraints apply)	<p><b>Construction</b></p> <p>Introduction and spread of diseases during construction could result in death of plants and animals (examples: Ash dieback, ranavirus). Introduction and assisted spread of invasive species during construction may result in squeezing out of native habitats and species.</p>	Major adverse	Permanent (diseases) and temporary (INNS spread).	<p>Mitigation will prevent the introduction of INNS to a negligible level of impact during construction and no change in operation.</p> <p>No residual effects predicted.</p>	No change	Neutral
		<p><b>Operation</b></p> <p>No operational impacts anticipated</p>	No change	N/A	No residual effects predicted.	No change	Neutral

Ecological receptor and valuation	Value	Summary of potential impacts	Level of impact pre-mitigation	Impact characterisation <sup>5</sup>	Summary of proposed mitigation/ compensation	Residual impact	Significance of residual effect
Other notable species (Common toad, hedgehog and fish species)	Local	<p><b>Construction</b></p> <p>Permanent loss of commuting routes and areas of shelter and foraging. Direct mortality of individuals from collisions with construction traffic, entrapment in excavations, disturbance from noise and light pollution of places of shelter leading to abandonment. Pollution risk of mortality of individuals from dust and accidental spills and changes to habitat suitability from sedimentation and water level changes.</p>	Minor adverse	Permanent	<p>No residual effects from pollution predicted.</p> <p>Where works are to be undertaken in water, the ECoW will be present to check for fish. If fish are detected a fish rescue will be required prior to instream works. This has been detailed within the EMP. This mitigation has been designed on a precautionary basis if fish species are present.</p>	Negligible adverse	Neutral
		<p><b>Operation</b></p> <p>Direct mortality of individuals through traffic collisions due to wider junction and road.</p> <p>Risk of mortality of individuals from surface water runoff, sedimentation, water level changes and reduction in habitat suitability. Disturbance from light pollution.</p>	Minor Adverse	Permanent	<p>Habitats to be remediated and some suitable habitat for these species will grow back quickly as not totally dependent on mature trees and hedgerows.</p> <p>Residual effects from barrier of new road and mortality from collisions likely to stay similar to that of the present road. Attenuation ponds for infiltration will be designed as a SuDS feature to reduce run-off and filter the water from contaminants.</p>	Negligible adverse	Neutral

## 8.11. Monitoring

- 8.11.1. All pre and post construction monitoring will be delivered as outlined in the EMP (**TR010037/APP/7.4**).
- 8.11.2. Monitoring during vegetation clearance and during construction where required will be undertaken by an Ecological Clerk of Works.
- 8.11.3. A pre-construction badger, otter survey shall be undertaken to assess whether the species have moved within the DCO boundary prior to construction and further mitigation is required.
- 8.11.4. Habitats, bird and bat boxes will be monitored and managed for five years after they have been created. Further details of the monitoring to be undertaken is set out in the EMP (**TR010037/APP/7.4**). Post-development monitoring will be required for newly created habitats and protected species and will be detailed in the REAC and EMP.
- 8.11.5. Road casualty surveys will be required for five years post construction to assess ongoing impacts on badger and barn owl on the site to assess whether mitigation provided is effective in reducing impacts on these species.
- 8.11.6. Species to be licensed, bat and water vole will be monitored as part of the respective licences for the requisite length of time after construction completion. Monitoring surveys will be consistent with the methodologies used to inform this assessment for comparisons to be made, and a report should be produced annually. Should adverse effects to these species be identified during the monitoring, further mitigation and monitoring would be discussed and agreed with the relevant consultees and implemented by the contractor. In addition, the bat crossing points (fencing and planting) would be monitored in years one, three and five after operation of the proposed road commences. This is specific bat mitigation separate to licence requirements added to the scheme at design stage.

## 8.12. Summary

- 8.12.1. The likely significant effects which have been predicted for each ecological receptor are reliant on the mitigation measures within Section 8.9 being implemented.
- 8.12.2. Although the design has evolved with the aim of avoiding trees where possible and habitat loss kept to the minimum, some areas of trees and other habitats will need to be lost due to the Proposed Scheme.
- 8.12.3. Species-rich grasslands within the scheme will have a slight beneficial level of impact after mitigation as there will be a net gain of more biodiverse grasslands

with the introduction of species-rich and marshy, wet grassland. The riparian planting along Cantley Stream will increase beneficial habitat for aquatic invertebrates which will provide a slight beneficial level of impact, both of these receptors have been assessed as a neutral residual effect.

- 8.12.4. It is anticipated that the scheme would have a Neutral effect on the European Designated Sites during construction and operation.
- 8.12.5. The scheme is anticipated to have a Neutral effect on Eaton Chalk Pit SSSI.
- 8.12.6. It is anticipated that there would be a Neutral effect during construction and operation on Eaton Common, Earlam Park Woods and Marston Marshes LNR and all County Wildlife Sites.
- 8.12.7. The priority habitats of lowland fens, traditional orchards, rivers, coastal and floodplain grazing marsh, standing water (ponds), wood pasture and parkland were assessed as being affected at a significance of neutral residual effects.
- 8.12.8. Deciduous woodland, and hedgerows will have significant moderate adverse residual effects due to the long-time lag to achieve their former maturity. The loss of two veteran trees would also have a significant large adverse residual effect as they are irreplaceable.
- 8.12.9. Protected species that are to be licensed (loss of bat roosts and water vole) would have neutral residual effects as mitigation within the licence method statements would be required and developed to remove any harm from occurring to them and would have to include increased habitat for them. Bats have a slight adverse residual effect overall, due to the time lag between loss of habitat and the remediated habitats reaching maturity which could lead to traffic mortality.
- 8.12.10. All other residual effects for construction and operation after mitigation would be neutral or slight adverse which are considered to be not significant for the assessment.



## 8.13. References

- All UK (and individual UK countries) legislation can be viewed at: <http://www.legislation.gov.uk/browse>
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## 8.14. Glossary

8.14.1. The terms and abbreviations used in this biodiversity chapter have been defined in Table 8-13 in line with standards from DMRB LA 108 Biodiversity.

Table 8-13 Definitions of terms and abbreviations

Term or abbreviation	Definition
Biodiversity	The variability among living organisms from all sources, including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part. This includes diversity within species, between species and of ecosystems.
Biodiversity resources	Ecological receptors that are present in the surrounding environment.
DAFOR	Method of assessing habitat composition. Species found in a habitat are classified as being Dominant, Abundant, Frequent, Occasional or Rare.
Designated sites	Internationally, nationally, or locally designated sites for species and/or habitats.
Ecological feature	Habitats, species or ecosystems which for the purposes of this document are collectively referred to as biodiversity resources.
Enhancement	Enhancement is improved management of a biodiversity resource or provision of new ecological features which result in a net benefit to biodiversity. Enhancement is 'over and above' that required to mitigate or compensate for a negative impact.
Habitat	The place or type of site where an organism or population naturally occurs. Often used in the wider sense referring to major assemblages of plants and animals found together.
Priority habitats and species	Those species and habitats which are defined in CIEEM's Guidelines for Preliminary Ecological Appraisal as: <ol style="list-style-type: none"> <li>1) listed as a national priority for conservation (such as those listed as habitats and species of principal importance for the conservation of biodiversity)</li> <li>2) listed as a local priority for conservation, for example in the relevant local Biodiversity Action Plan (BAP)</li> <li>3) Red Listed using International Union for the Conservation of Nature (IUCN) criteria or, where a more recent assessment of the taxonomic group has not yet been undertaken, listed in a Red Data Book</li> <li>4) listed as Near Threatened or Amber Listed</li> <li>5) listed as a Nationally Rare or Nationally Scarce species or listed as a Nationally Notable species where a more recent assessment of the taxonomic group has not yet been undertaken</li> <li>6) endemic to a country or geographic location</li> </ol>

Term or abbreviation	Definition
Significant effect	An effect that either supports or undermines biodiversity conservation objectives for biodiversity resources or for biodiversity in general. These are, for example, impacts on structure and function of defined sites, habitats, or species and the conservation status of habitats and species (including extent, abundance and distribution).
Zone of influence	The area(s) over which biodiversity resources can be affected by biophysical changes as a result of the proposed project and associated activities.
BAP	Biodiversity Action Plan
CIEEM	Chartered Institute of Ecology and Environmental Management
CWS	County wildlife site
EcIA	Ecological impact assessment
IUCN	International Union for Conservation of Nature
LNR	Local nature reserves.
SAC	Special Areas of Conservation.
SPA	Special Protection Area.
SSSI	Sites of Special Scientific Interest.