

Norfolk Boreas Offshore Wind Farm

Chapter 22

Onshore Ecology

Environmental Statement

Volume 1

Applicant: Norfolk Boreas Limited
Document Reference: 6.1.22
RHDHV Reference: PB5640-006-022
Pursuant to APFP Regulation: 5(2)(a)

Date: June 2019
Revision: Version 1
Author: Royal HaskoningDHV

Photo: Ormonde Offshore Wind Farm

Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
27/02/19	01D	First draft for Norfolk Boreas Limited review	GC	CS/AH/KW	CD/JL
29/03/19	02D	Second draft for Norfolk Boreas Limited review	GC	CD/JL/AH	AmH/JL
01/05/19	01F	Final for DCO submission	GC	CD	JL



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Glossary of Acronyms

AONB	Area of Outstanding Natural Beauty
BAP	Biodiversity Action Plan
BCT	Bat Conservation Trust
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute for Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CMS	Construction Method Statement
CRoW	Countryside and Rights of Way Act
CWS	County Wildlife Site
dB	Decibels
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
EclA	Ecological Impact Assessment
EEC	European Economic Community
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
EPS	European Protected Species
ES	Environmental Statement
ETG	Expert Topic Group
ha	Hectares
HDD	Horizontal Directional Drilling
HRA	Habitats Regulations Assessment
HSI	Habitat Suitability Index
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
ICZM	Integrated Coastal Zone Management
IPC	Infrastructure Planning Committee
JNCC	Joint Nature Conservation Committee
LBAP	Local Biodiversity Action Plan
LNR	Local Nature Reserve
LwA	Sound power level
m	Metres
NBSG	Norfolk Barbastelle Study Group
NERC Act	Natural Environment and Rural Communities Act
NNR	National Nature Reserve
NPPF	National Planning Policy Framework
NPS	National Policy Statement
NVC	National Vegetation Classification
NWT	Norfolk Wildlife Trust
O&M	Operations and Maintenance
OLEMS	Outline Landscape Environmental Management Strategy
PMoW	Precautionary Method of Working
PEIR	Preliminary Environmental Information Report

pSPA	Potential Special Protection Area
RNR	Roadside Nature Reserve
RPA	Root Protection Area
SAC	Special Area of Conservation
SNCB	Statutory Nature Conservation Body
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TN	Target Note
UK BAP	UK Biodiversity Action Plan
UKHPI	UK Habitat of Principal Importance

Glossary of Terminology

Attenuation pond zone	Zone within which the attenuation pond at the onshore project substation or Necton National Grid substation will be located.
Cable pulling	Installation of cables within pre-installed ducts from jointing pits located along the onshore cable route.
Ducts	A duct is a length of underground piping, which is used to house electrical and communication cables.
Indicative mitigation planting	Areas identified for mitigation planting at the onshore project substation and Necton National Grid substation.
Jointing pit	Underground structures constructed at regular intervals along the onshore cable route to join sections of cable and facilitate installation of the cables into the buried ducts.
Landfall	Where the offshore cables come ashore at Happisburgh South.
Landfall compound	Compound at landfall within which HDD drilling would take place.
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing low voltage electrical earthing links.
Mobilisation area	Areas approx. 100 x 100m used as access points to the running track for duct installation. Required to store equipment and provide welfare facilities. Located adjacent to the onshore cable route, accessible from local highways network suitable for the delivery of heavy and oversized materials and equipment.
National Grid new / replacement overhead line tower	New overhead line towers to be installed at the National Grid substation.
National Grid overhead line modifications	The works to be undertaken to complete the necessary modification to the existing 400kV overhead lines.
National Grid substation extension	The permanent footprint of the National Grid substation extension.
National Grid temporary works area	Land adjacent to the Necton National Grid substation which would be temporarily required during construction of the National Grid substation extension.
Necton National Grid substation	The grid connection location for Norfolk Boreas and Norfolk Vanguard
Onshore 400kV cable route	Buried high-voltage cables linking the onshore project substation to the Necton National Grid substation.
Onshore cables	The cables which take the electricity from landfall to the onshore project

	substation.
Onshore cable route	The up to 35m working width within a 45m wide corridor which will contain the buried export cables as well as the temporary running track, topsoil storage and excavated material during construction.
Onshore project area	The area of the onshore infrastructure (landfall, onshore cable route, accesses, trenchless crossing zones and mobilisation areas; onshore project substation and extension to the Necton National Grid substation and overhead line modifications).
Onshore project substation	A compound containing electrical equipment to enable connection to the National Grid. The substation will convert the exported power from HVDC to HVAC, to 400kV (grid voltage). This also contains equipment to help maintain stable grid voltage.
Running track	The track along the onshore cable route which the construction traffic would use to access workfronts.
The Applicant	Norfolk Boreas Limited
The project	Norfolk Boreas Wind Farm including the onshore and offshore infrastructure.
Transition pit	Underground structures that house the joints between the offshore export cables and the onshore cables.
Trenchless crossing zone (e.g. HDD)	Areas within the onshore cable route which will house trenchless crossing entry and exit points.
Workfront	A length of onshore cable route within which duct installation works will occur, approximately 150m.

22 ONSHORE ECOLOGY

22.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the potential impacts of the proposed Norfolk Boreas project (herein 'the project') on onshore ecology.
2. This chapter provides an overview of the existing baseline environment in respect to onshore ecology within a study area around the project onshore infrastructure. This chapter then provides an Ecological Impact Assessment (EclA) of the potential impacts of construction, operation and decommissioning of the onshore cable and associated infrastructure for the project based on the baseline environment available at the time of the production of this chapter.
3. Vattenfall Wind Power Limited (VWPL) (the parent company of Norfolk Boreas Limited) is also developing Norfolk Vanguard, a 'sister project' to Norfolk Boreas. To minimise impacts associated with onshore construction works for the two projects, Norfolk Vanguard are seeking to obtain consent to undertake enabling works for both projects at the same time. However, Norfolk Boreas needs to consider the possibility that Norfolk Vanguard may not proceed to construction.
4. The EclA has therefore been undertaken using the following two alternative scenarios (further details are presented in Chapter 5 Project Description):
 - **Scenario 1** – Norfolk Vanguard proceeds to construction and installs ducts and other shared enabling works for Norfolk Boreas.
 - **Scenario 2** – Norfolk Vanguard does not proceed to construction and Norfolk Boreas proceeds alone. Norfolk Boreas undertakes all works required as an independent project.
5. This EclA also considers transboundary impacts, and cumulative impacts of existing and proposed projects in respect of onshore ecology.
6. This chapter refers to other chapters within this ES which present baseline data or impact assessments which are relevant to the assessment of potential impacts upon onshore ecology. The relevant chapters are:
 - Chapter 20 Water Resources and Flood Risk;
 - Chapter 23 Onshore Ornithology;
 - Chapter 25 Noise and Vibration;
 - Chapter 26 Air Quality; and
 - Chapter 29 Landscape and Visual Impact Assessment.
7. Potential impacts on birds are not considered in this chapter but are discussed in full in Chapter 23 Onshore Ornithology.

22.2 Legislation, Guidance and Policy

22.2.1 Legislation

8. There are a number of pieces of legislation applicable to onshore ecology. The following sections provide detail on key pieces of International and UK legislation which are relevant to this chapter.

22.2.1.1 Habitats Directive - Council Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora

9. This Directive provides protection for specific habitats listed in Annex I and species listed in Annex II of the Directive. The Directive sets out decision making procedures for the protection of Special Areas of Conservation (SAC) and Special Protection Areas (SPA), implemented in the UK through The Conservation of Habitats and Species Regulations 2017.
10. The European Union (Withdrawal) Act 2018 ensures that all statutory instruments created under EU Directives, including The Conservation of Habitats and Species Regulations 2017, will continue to apply once the UK exits the European Union.

22.2.1.2 Birds Directive - Council Directive 79/409/EEC on the Conservation of Wild Birds

11. This Directive provides a framework for the conservation and management of wild birds in Europe (also see Chapter 23 Onshore Ornithology). The most relevant provisions of the Directive are the identification and classification of SPAs for rare or vulnerable species listed in Annex I of the Directive and for all regularly occurring migratory species (required by Article 4). It also establishes a general scheme of protection for all wild birds (required by Article 5). The Directive requires national Governments to establish SPAs and to have in place mechanisms to protect and manage them. The SPA protection procedures originally set out in Article 4 of the Birds Directive have been replaced by the Article 6 provisions of the Habitats Directive, and are implemented in the UK through The Conservation of Habitats and Species Regulations 2017.

22.2.1.3 Wildlife and Countryside Act 1981 (as amended)

12. This Act makes it an offence (with exception to species listed in Schedule 2 and with additional penalties for species listed in Schedule 1) to intentionally: kill, injure, or take any wild bird; take, damage or destroy the nest of any wild bird while that nest is in use or being built; and take or destroy an egg of any wild bird.
13. The Act makes it an offence to intentionally kill, injure or take any animal listed in Schedule 5 of the act and protects occupied and unoccupied places used for shelter or protection.

14. The Act makes it an offence (subject to exceptions) to intentionally pick, uproot or destroy any wild plant listed in Schedule 8 of the Act.
15. The Act makes it a criminal offence to plant or otherwise cause to grow any non-native, invasive species listed under Schedule 9 of the Act.
16. The Act makes provision for the notification and confirmation of Sites of Special Scientific Interest (SSSI).

22.2.1.4 The Conservation of Habitats and Species Regulations 2017

17. The Regulations transpose the Council Directive 92 / 43 / EEC the 'Habitats Directive' in to national law (in respect of England and Wales) and requires the state to designate SACs and SPAs.
18. The Regulations make it an offence (subject to exceptions) to deliberately capture, kill, disturb, or trade in the animals listed in Schedule 2, or pick, collect, cut, uproot, destroy, or trade in the plants listed in Schedule 4.
19. The Regulations require competent authorities to consider or review planning permission, applied for or granted, affecting a European site, and, subject to certain exceptions, restrict or revoke permission where the integrity of the site would be adversely affected.

22.2.1.5 The Protection of Badgers Act 1992

20. The Act makes it an offence to wilfully kill, injure or take, or attempt to kill, injure or take a badger *Meles meles*; and to cruelly ill-treat a badger.
21. The Act makes it an offence to intentionally or recklessly damage, destroy or obstruct a badger sett, or to disturb a badger whilst in a sett.

22.2.1.6 Natural Environment and Rural Communities (NERC) Act 2006

22. Section 41 of the Act requires the Secretary of State to compile a list of habitats and species of principal importance for the conservation of biodiversity in England (herein 'S41 species').
23. Decision makers of public bodies, in the execution of their duties, must have regard to the conservation of biodiversity in England, and the list is intended to guide them.

22.2.1.7 The Hedgerow Regulations 1997

24. The Regulations make it an offence to remove or destroy certain hedgerows without permission from the local planning authority and the local planning authority is the enforcement body for such offences.

22.2.1.8 Marine and Coastal Access Act 2009

25. The Act includes provisions for the coastal environment including improving access to the coast and undertaking Integrated Coastal Zone Management (ICZM), which

brings policy makers, decision makers and stakeholders together to manage coastal and estuarine areas.

22.2.1.9 The Commons Act 2006

26. The Act aims to protect areas of common land, in a sustainable manner delivering benefits for farming, public access and biodiversity (Department for Environment, Food and Rural Affairs (Defra), 2013).

22.2.1.10 Countryside and Rights of Way Act 2000 (CRoW)

27. The Act amends the law relating to public rights of way including making provision for public access on foot to certain types of land. Amendments are made in relation to SSSIs to improve their management and protection, as well as to the Wildlife and Countryside Act 1981, to strengthen the legal protection for threatened species. Provision is also made for Areas of Outstanding Natural Beauty (AONB) to improve their management.

22.2.2 Guidance

28. The impact assessment has been based upon the following guidance and standards:
- Chartered Institute of Ecology and Environmental Management (CIEEM) (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine;
 - British Standard 42020:2013 – Biodiversity. Code of Practice for planning and development;
 - Construction Industry Research and Information Association (CIRIA) C648 (2006) Control of water pollution from linear construction projects; and
 - CIRIA Guidance note C692 Environmental Good Practice on Site Guide (3rd Edition).
29. The following species-specific guidance and standards have been used during the EclA process:
- Standing advice on protected species:
 - Natural England (2014a) Otters: surveys and mitigation for development projects. Natural England Standing Advice;
 - Natural England (2014b) White-clawed crayfish: surveys and mitigation for development projects. Natural England Standing Advice;
 - Natural England (2015a) Badgers: surveys and mitigation for development projects. Natural England Standing Advice;
 - Natural England (2015b) Bats: surveys and mitigation for development projects. Natural England Standing Advice;
 - Natural England (2015c) Great crested newts: surveys and mitigation for development projects. Natural England Standing Advice;

- Natural England (2015d) Invertebrates: surveys and mitigation for development projects. Natural England Standing Advice;
- Natural England (2015e) Reptiles: surveys and mitigation for development projects. Natural England Standing Advice; and
- Natural England (2015f) Water voles: surveys and mitigation for development projects. Natural England Standing Advice.
- Natural England and Forestry Commission (2018) Ancient woodland and veteran trees: protecting them from development. Natural England and Forestry Commission Standing Advice;
- British Standard 5837: 2012 – Trees in relation to design, demolition and construction;
- Bat Conservation Trust (BCT) and Institute of Lighting Engineers (ILP) (2018) Bats and Artificial Lighting in the UK;
- Dean et al. (2016) The Water Vole Mitigation Handbook (The Mammal Society Guidance Series);
- Edgar et al. (2010) Reptile Habitat Management Handbook;
- English Nature (2001) Great Crested Newt Mitigation Guidelines;
- Joint Nature Conservation Committee (JNCC) (2003) Herpetofauna Worker’s Manual;
- Strachan and Moorhouse (2011) Water Vole Conservation Handbook, 3rd Edition; and
- GB Non-native Species Secretariat Species Information (Updated 2015) (<http://www.nonnativespecies.org/factsheet/index.cfm>).

22.2.3 Policy

22.2.3.1 National Planning Policy Framework (NPPF)

30. The NPPF, first published in 2012 and revised in 2018 replaces the former series of Planning Policy Statements. From its outset the document makes plain that it is concerned with Sustainable Development, and paragraph 8 states that there are three objectives to which the planning system will seek to achieve sustainable development: economic, social and environmental, and that all three are interdependent and need to be pursued in mutually support ways. The environmental objective is defined (as per the framework document) below:

- “an environmental objective – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy”.

22.2.3.2 Natural Environment White Paper 2011

31. The paper was the first White Paper produced by the government in 20 years. The paper contains plans to reconnect nature, connect people and nature for better quality of life and capture and improve the value of nature.

22.2.3.3 A Green Future: Our 25 Year Plan to Improve the Environment 2018

32. The plan sets out 10 goals and a range of high-level policies aimed at helping “the natural world regain and retain good health”. The key policies within the plan relevant for this chapter are:

- Embedding an ‘environmental net gain’ principle for development, including housing and infrastructure;
- Focusing on woodland to maximise its many benefits; and
- Protecting and recovering nature (including improving biosecurity to protect and conserve nature).

22.2.3.4 Biodiversity 2020: A Strategy for England’s wildlife and ecosystem services

33. The Strategy sets out how England will implement the 2010 Aichi Biodiversity Targets, European Commission’s 2011 EU Biodiversity Strategy and the recommendations of the 2011 Natural Environment White Paper. It contains the following relevant targets:

- Better wildlife habitats with 90% of priority habitats in favourable or recovering condition and at least 50% of SSSIs in favourable condition, while maintaining at least 95% in favourable or recovering condition;
- More, bigger and less fragmented areas for wildlife, with no net loss of priority habitat and an increase in the overall extent of priority habitats by at least 200,000ha;
- By 2020, at least 17% of land and inland water, especially areas of particular importance for biodiversity and ecosystem services, conserved through effective, integrated and joined up approaches to safeguard biodiversity and ecosystem services including through management of our existing systems of protected areas and the establishment of nature improvement areas;
- Restoring at least 15% of degraded ecosystems as a contribution to climate change mitigation and adaptation;
- By 2020, to see an overall improvement in the status of our wildlife and to prevent further human-induced extinctions of known threatened species; and
- By 2020, significantly more people to be engaged in biodiversity issues, aware of its value and taking positive action.

22.2.3.5 National Policy Statements

34. The assessment of potential impacts upon terrestrial ecology has been made with specific reference to the relevant National Policy Statements (NPS). These are the

principal decision-making documents for Nationally Significant Infrastructure Projects (NSIPs). Those relevant to the project are:

- Overarching NPS for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a);
- NPS for Renewable Energy Infrastructure (EN-3) (DECC, 2011b); and
- NPS for Electricity Networks Infrastructure (EN-5) (DECC, 2011c).

35. The specific assessment requirements for terrestrial ecology, as detailed in the NPSs, are summarised in Table 22.1, together with an indication of the paragraph numbers of the ES chapter where each is addressed.

Table 22.1 NPS assessment requirements relevant to onshore ecology

NPS Requirement	NPS Reference	ES Reference
EN-1 Overarching NPS for Energy		
<p>‘Where the development is subject to EIA [Environmental Impact Assessment] the applicant should ensure that the ES [Environmental Statement] clearly sets out any effects on internationally, nationally and locally designated sites of ecological or geological conservation importance, on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity. The applicant should provide environmental information proportionate to the infrastructure where EIA is not required to help the Infrastructure Planning Commission (IPC) [now the Planning Inspectorate and the Secretary of State] consider thoroughly the potential effects of a proposed project.’</p>	Section 5.3.3	Existing environment is discussed in section 22.6. Assessment is set out in sections 22.7 and 22.8.
<p>‘The applicant should show how the project has taken advantage of opportunities to conserve and enhance biodiversity and geological conservation interests.’</p>	Section 5.3.4	Embedded mitigation measures are presented in section 22.7.1 and further mitigation measures are set out in sections 22.7 and 22.8.
<p>‘When considering the application, the IPC will have regard to the Government’s biodiversity strategy as (sic) set out in ‘Working with the grain of nature’, which aims to halt or reverse declines in priority habitats and species; accept the importance of biodiversity to quality of life. The IPC will consider this in relation to the context of climate change.</p> <p>As a general principle, and subject to the specific policies below, development should aim to avoid significant harm to biodiversity and geological conservation interests, including through mitigation and consideration of reasonable alternatives (as set out in section 4.4 above); where significant harm cannot be avoided, then appropriate compensation measures should be sought.</p> <p>In taking decisions, the IPC should ensure that appropriate weight is attached to designated sites of international,</p>	Sections 5.3.5 – 5.3.8	Embedded mitigation measures are presented in section 22.7.1 and further mitigation measures are set out in sections 22.7 and 22.8.

NPS Requirement	NPS Reference	ES Reference
national and local importance; protected species; habitats and other species of principal importance for the conservation of biodiversity; and to biodiversity and geological interests within the wider environment.'		
'The IPC will have the same regard to potential Special Protection Areas (pSPAs) and Ramsar sites as those sites identified through international conventions and European Directives.'	Section 5.3.9	Designated sites are discussed in section 22.6. Assessment is set out in sections 22.7 and 22.8. Site selection decisions have been made to avoid interest features at designated sites.
'Many SSSIs are also designated as sites of international importance and will be protected accordingly. Those that are not, or those features of SSSIs not covered by an international designation, should be given a high degree of protection.'	Section 5.3.11	Designated sites are discussed in section 22.6. Assessment is set out in sections 22.7 and 22.8. Site selection decisions have been made to avoid interest features at designated sites.
'Where a proposed development on land within or outside an SSSI is likely to have an adverse effect on an SSSI (either individually or in combination with other developments), development consent should not normally be granted. Where an adverse effect, after mitigation, on the site's notified special interest features is likely, an exception should only be made where the benefits (including need) of the development at this site, clearly outweigh both the impacts that it is likely to have on the features of the site that make it of special scientific interest and any broader impacts on the national network of SSSIs.'	Section 5.3.11	Designated sites are discussed in section 22.6. Assessment is set out in sections 22.7 and 22.8. Site selection decisions have been made to avoid interest features at designated sites.
'The IPC will have regard to sites of regional and local biodiversity and geological interest, which include Regionally Important Geological Sites, Local Nature Reserves and Local Sites when considering applications since they are recognised to have a fundamental role in meeting overall national biodiversity targets.'	Section 5.3.13	Designated sites are discussed in section 22.6. Assessment is set out in sections 22.7 and 22.8. Site selection decisions have been made to avoid interest features at designated sites.
'Ancient woodland is a valuable biodiversity resource both for its diversity of species and for its longevity as woodland. Once lost it cannot be recreated. The IPC should not grant development consent for any development that would result in its loss or deterioration unless the benefits (including need) of the development, in that location outweigh the loss of the woodland habitat. Aged or 'veteran' trees found outside ancient woodland are also particularly valuable for biodiversity and their loss should be avoided.'	Section 5.3.14	Impacts to woodland and trees are discussed in sections 22.7 and 22.8, including avoidance and mitigation measures.

NPS Requirement	NPS Reference	ES Reference
Where such trees would be affected by development proposals the applicant should set out proposals for their conservation or, where their loss is unavoidable, the reasons why.'		
The IPC will aim to maximise opportunities to build in beneficial biodiversity features when considering proposals as part of good design.	Section 5.3.15	Embedded mitigation measures are presented in section 22.7.1 and further mitigation measures are set out in sections 22.7 and 22.8. This includes replanting and reinstatement of habitat where considered necessary.
<p>The IPC shall have regard to the protection of legally protected species and habitats and species of principal importance for nature conservation.</p> <p>'The IPC shall refuse consent where harm to the habitats or species and their habitats would result, unless the benefits (including need) of the development outweigh that harm. In this context the IPC should give substantial weight to any such harm to the detriment of biodiversity features of national or regional importance which it considers may result from a proposed development.'</p>	Sections 5.3.16 – 5.3.17	The existing environment for protected and important species and habitats is discussed in section 22.6. Assessment is set out in sections 22.7 and 22.8.
<p>The applicant should include appropriate mitigation measures as an integral part of the proposed development and demonstrate that:</p> <ul style="list-style-type: none"> • during construction, they will seek to ensure that activities will be confined to the minimum areas required for the works; • during construction and operation best practice will be followed to ensure that risk of disturbance or damage to species or habitats is minimised, including as a consequence of transport access arrangements; • habitats will, where practicable, be restored after construction works have finished; and • opportunities will be taken to enhance existing habitats and, where practicable, to create new habitats of value within the site landscaping proposals. 	Section 5.3.18	Embedded mitigation measures are presented in section 22.7.1 and further mitigation measures are set out in sections 22.7 and 22.8. This includes replanting and reinstatement of habitat where considered necessary.
'The IPC will need to take account of what mitigation measures may have been agreed between the applicant and Natural England, and whether Natural England has granted or refused or intends to grant or refuse, any relevant licences, including protected species mitigation licences.'	Section 5.3.20	Embedded mitigation measures are presented in section 22.7.1 and further mitigation measures are set out in sections 22.7 and 22.8.
EN-3 NPS for Renewable Energy Infrastructure		
'Proposals for renewable energy infrastructure should demonstrate good design in respect of landscape and visual	Section 2.4.2	Project design has avoided sensitive features where

NPS Requirement	NPS Reference	ES Reference
amenity, and in the design of the project to mitigate impacts such as noise and effects on ecology.'		possible. Embedded mitigation measures are presented in section 22.7.1 and further mitigation measures are set out in sections 22.7 and 22.8.
'Ecological monitoring is likely to be appropriate during the construction and operational phases to identify the actual impact so that, where appropriate, adverse effects can then be mitigated and to enable further useful information to be published relevant to future projects.'	Section 2.6.70	Monitoring is discussed in mitigation set out in sections 22.7 and 22.8.
'There may be some instances where it would be more harmful to the ecology of the site to remove elements of the development, such as the access tracks or underground cabling, than to retain them.'	Section 2.7.15	Decommissioning is discussed in section 22.7.7

22.2.3.6 Local Planning Policy

36. EN-1 states, in paragraph 4.1.5 that:

- “Other matters that the IPC [now the Planning Inspectorate and the Secretary of State] may consider important and relevant to its decision-making may include Development Plan Documents or other documents in the Local Development Framework. In the event of a conflict between these or any other documents and an NPS, the NPS prevails for the purposes of IPC decision making given the national significance of the infrastructure.”

37. The onshore project area falls within the following local authority boundaries:

- Norfolk County Council;
- Breckland Council;
- Broadland District Council; and
- North Norfolk District Council.

37. Table 22.2 provides details of the local planning policy documents and the relevant policies in respect of onshore ecology. Designated areas which these policies may refer to are shown on Figure 22.2. A number of policies which primarily relate to the management of water resources, and which are inter-linked with onshore ecology are discussed in Chapter 20 Water Resources and Flood Risk.

Table 22.2 Relevant local planning policies

Document	Policy / Guidance	Policy / Guidance purpose
Norfolk County Council		
Norfolk County Council's Environmental Policy (2016)	1	Protect and enhance the county's wildlife and the quality and character of the Norfolk landscape and coast; encouraging the variety of habitats and species to deliver the aims of Biodiversity 2020.
	2	Ensure nature contributes to the economic and social health of urban and rural areas in Norfolk for current and future generations.
Breckland Council		
Breckland Council Adopted Core Strategy and Development Control Policies Development Plan Document (2009)	SS1 Spatial Strategy	Minimal development within the countryside, including the comprehensive protection from development of: <ul style="list-style-type: none"> • Breckland SPA and its qualifying features; • SSSIs; • Ramsar site at Redgrave and South Lopham Fen; • NNRs [National Nature Reserves]/ LNRs [Local Nature Reserves]; • Any areas identified as priority habitats or target areas for habitat creation in the Norfolk Biodiversity Action Plan.
	CP10 Natural Environment	The enhancement of biodiversity and geodiversity in the district will be sought. There is an expectation that development will incorporate biodiversity or geological features where opportunities exist. Development that fails to exploit opportunities to incorporate available biodiversity or geological features will not be considered appropriate. All international, national, regional and local sites (CWS [County Wildlife Site], Ancient woodland, LNRs, UK Habitat of Principal Importance [UKHPI]) for wildlife conservation will require a full environmental assessment for any development proposals which may affect them. A buffer zone of 1,500m around the Breckland SPA, within which certain development controls are in place. Ecological networks should be considered by any development proposal. This includes major river valleys and connections between core woodland areas within and outside the district.
	DC12 Trees and Landscape	Any development that would result in the loss of, or the deterioration in the quality of, an important natural feature(s), including protected trees and hedgerows will not normally be permitted. The retention of trees, hedgerows and other natural features in-situ will always be preferable. Where the loss of such features is unavoidable, replacement provision should be of a commensurate value to that which is lost.

Document	Policy / Guidance	Policy / Guidance purpose
		Appropriate landscaping schemes to mitigate against the landscape impact of and complement the design of new development will be required, where appropriate.
Broadland District Council		
Joint Core Strategy for Broadland, Norwich and South Norfolk (2011; updated 2014)	Policy 1: Addressing climate change and protecting environmental assets	<p>The environmental assets of the area will be protected, maintained, restored and enhanced and the benefits for residents and visitors improved.</p> <p>All new developments will ensure that there will be no adverse impacts on European and Ramsar designated sites and no adverse impacts on European protected species in the area and beyond including by storm water runoff, water abstraction, or sewage discharge.</p> <p>In areas not protected through international or national designations, development will:</p> <ul style="list-style-type: none"> Minimise fragmentation of habitats and seek to conserve and enhance existing environmental assets of acknowledged regional or local importance. Where harm is unavoidable, it will provide for appropriate mitigation or replacement with the objective of achieving a long-term maintenance or enhancement of the local biodiversity baseline.
North Norfolk District Council		
North Norfolk Local Development Framework: Core Strategy (2008, updated 2011)	SS1 Spatial Strategy for North Norfolk and SS2 Development in the Countryside	North Norfolk outside of named settlements is designated as Countryside and development will be restricted to particular types of development to support the rural economy, meet affordable housing needs and provide renewable energy.
	EN3 Undeveloped Coast	In the Undeveloped Coast only development that can be demonstrated to require a coastal location and that will not be significantly detrimental to the open coastal character will be permitted.
	EN7 Renewable Energy	<p>Renewable energy proposals will be supported and considered in the context of sustainable development and climate change, taking account of the wide environmental, social and economic benefits of renewable energy gain.</p> <p>Large scale renewable energy proposals should deliver economic, social, environmental or community benefits that are directly related to the proposed development and are of reasonable scale and kind to the local area.</p>
	EN9 Biodiversity and Geology	<p>All development proposals should:</p> <ul style="list-style-type: none"> Protect the biodiversity value of land and buildings and minimise fragmentation of habitats;

Document	Policy / Guidance	Policy / Guidance purpose
		<ul style="list-style-type: none"> • Maximise opportunities for restoration, enhancement and connection of natural habitats; and • Incorporate beneficial biodiversity conservation features where appropriate. <p>Development proposals that would cause a direct or indirect adverse effect to nationally designated sites or other designated areas or protected species will not be permitted unless:</p> <ul style="list-style-type: none"> • They cannot be located on alternative sites that would cause less or no harm; • The benefits of the development clearly outweigh the impacts on the features of the site and the wider network of natural habitats; and • Prevention, mitigation and compensation measures are provided.

22.3 Consultation

38. Consultation is a key driver of the EIA process, and is an ongoing process throughout the lifecycle of the project, from the initial stages through to consent and post-consent. To date, consultation regarding onshore ecology has been conducted through the Scoping Report (Royal HaskoningDHV, 2017) the Evidence Plan Process (EPP), namely the Onshore Ecology and Ornithology Method Statement (Royal HaskoningDHV, 2018, unpublished) and the Preliminary Environmental Information Report (PEIR) (Norfolk Boreas Limited, 2018). Feedback received during the process to date has been incorporated into this ES.
39. Further consultation has been undertaken through an Expert Topic Group (ETG) meeting held in February 2019.
40. As the majority of the onshore infrastructure for Norfolk Boreas and Norfolk Vanguard is co-located, the pre-application consultation undertaken for Norfolk Vanguard is relevant to both projects and has been used to inform the approach to this assessment. In addition, where possible any comment received as part of the Norfolk Vanguard examination process, up to Deadline 5 (20th March 2019) have also be considered. The Norfolk Vanguard responses considered are provided in Appendix 22.11.
41. Further details regarding the project consultation process are included the Consultation Report (document reference 5.1).
42. A summary of the consultation undertaken for Norfolk Boreas to date is provided in Table 22.3.

Table 22.3 Norfolk Boreas Consultation responses

Consultee	Document / Date	Comment	Response / where addressed in the ES
Secretary of State	Scoping Opinion June 2017	The ES should make it clear how the zone of influence for the project has been defined and how this has been used to identify the ecological receptors likely to be affected by the proposals.	The study areas used within this EclA are set out in section 22.5.
Secretary of State	Scoping Opinion June 2017	The summary of impacts provided in [the scoping report] excludes effects during operation from permanent/temporary habitat loss, temporary/permanent habitat fragmentation and the spread of non-invasive species. While it is acknowledged that effects from non-invasive species are more likely to occur during the construction and decommissioning phases it is not clear why effects on permanent habitat loss and fragmentation have been scoped out. The SoS [Secretary of State] does not agree that sufficient evidence has been presented to allow these effects to be scoped out.	Potential impacts arising from permanent loss of habitat is considered in section 22.7 under construction impacts. These impacts are not included again in section 22.7.6 under operation impacts, as this would be double-counting.
Secretary of State	Scoping Opinion June 2017	The intention to produce an Invasive Species Management Plan is welcomed. The Applicant's attention is drawn to the comments from NE [Natural England] and the EA [Environment Agency] in Appendix 3 regarding the presence of invasive species, particularly in relation to aquatic habitats, and the need to provide a detailed assessment of biosecurity requirements in the ES.	Biosecurity measures required are discussed in sections 22.7 and 22.8 of this chapter.
Secretary of State	Scoping Opinion June 2017	The Applicant is strongly advised to consider the advice from NE and the EA on the potential risks associated with the use of Horizontal Direct Drilling (HDD) under the River Wensum (see Appendix 3 of this report) and how these might be minimised.	Consideration of impacts upon the River Wensum are discussed in sections 22.7 and 22.8 of this chapter.
Secretary of State	Scoping Opinion June 2017	It is not entirely clear from the Scoping Report whether effects on the River Wensum SAC/SSSI will be covered in the onshore ecology section of the ES or in the section dealing with water resources and flood risk. Given the statutory ecological designations covering the River Wensum the SoS recommends that the ecological effects are reported in the onshore	Consideration of impacts upon the River Wensum SAC / SSSI are discussed in sections 22.7 and 22.8 of this chapter.

Consultee	Document / Date	Comment	Response / where addressed in the ES
		ecology chapter with appropriate cross referencing to the water resources chapter.	
Secretary of State	Scoping Opinion June 2017	The Applicant's attention is drawn to the comments from NE in Appendix 3 of this Opinion about the potential cumulative effects from the Norfolk Boreas, Norfolk Vanguard and Hornsea Three wind farms onshore cables and coastal defence works. The Applicant is advised to specifically discuss the potential for these cumulative effects through the EPP so as to inform the EIA cumulative assessment.	Cumulative impacts arising from these three projects are considered in section 22.8 of this chapter.
Environment Agency	Scoping Opinion June 2017	Baseline data sources appear to be thorough for the various ecological receptors although there didn't appear to be information included about possible riparian impacts of the proposed works to marginal habitat, for example impact to water voles and other protected species that may be present.	Full water vole surveys of all watercourses to which survey access was available was conducted in 2017 and 2018. Field signs of otter were also searched for along all riparian habitats to which survey access was available. Potential impacts upon sensitive ecological features of the River Wensum and notable fish species were also considered. Impacts upon all these species are presented in sections 22.7 and 22.8 of this chapter.
Environment Agency	Scoping Opinion June 2017	Further detail should be included in relation to invasive non-native species and the disease they may spread. ...The cable route is shown to pass through the River Bure and Wensum catchments where American signal crayfish are present (and found recently to be infected by crayfish plague which is fatal to our native species). Chinese mitten crab are also present in our waterbodies and off the Norfolk coast, these also act as a vector for the spread of crayfish plague so making sure appropriate biosecurity techniques are in place is vital for works both off and onshore are paramount.	Biosecurity measures required are discussed in sections 22.7 and 22.8 of this chapter.

Consultee	Document / Date	Comment	Response / where addressed in the ES
		Therefore, a detailed assessment of biosecurity requirements in the Environmental Statement is necessary. Every part of the cable route should be assessed for species present, where is passing through next and how this can be managed to reduce spread. Measures detailing how equipment, plant, etc. will be treated between sites should be included.	
Environment Agency	Scoping Opinion June 2017	Whilst HDD is the preferred method for routing cable under sensitive features, risk of bentonite leaks as described would not be acceptable where risk of a leak can be appropriately managed to ensure this doesn't happen. ...Given the risk of drill fluid release into sensitive receptors the following measures be factored into the Environmental Statement and construction method statements: Where HDD is proposed, soils of the site must be fully assessed to understand the potential risk of fluid release into sensitive receptors. The drill path must be kept sufficiently deep to reduce the potential of drilling fluid releases reaching a receptor Access pits are dug a suitable distance back from waterbodies, whilst taking into account the potential effects that this may have on the surrounding area. Operatives to monitor drilling fluid pressure and the volume of drilling fluid returns, to detect losses. A contingency plan is produced in case of drilling fluid pressure decreases. The ground surface above the drilling path must be inspected for evidence of inadvertent drilling fluid releases The sensitive receptor must be monitored for evidence of inadvertent drilling fluid releases. This risk can be minimised using best practice and ensuring that the drilling occurs at sufficient depth below the river/ground surface. Clean-up materials and equipment, such as straw bales, sandbags, silt traps etc. must be present on site during the drilling operations.	Measures to minimise the impacts of bentonite leaks are discussed in sections 22.7 and 22.8 of this chapter.
Forestry Commission	Scoping Opinion June 2017	We would expect the environmental statement to consider how these techniques impact on any woodland to	These indirect effects on ancient woodland are discussed in

Consultee	Document / Date	Comment	Response / where addressed in the ES
		which they are applied: the likely impacts of disturbance, dust, water table effects and lighting. This should also encompass how the recommended '15 metre buffer' between any development and Ancient Woodland described in the Standing Advice for Ancient Woodland (from the canopy edge and not from the trunks of trees) will be applied as a protective measure.	sections 22.7 and 22.8 of this chapter.
ETG (Norfolk County Council, Breckland Council, Broadland District Council, North Norfolk District Council)	Norfolk Boreas Onshore Ecology and Ornithology Method Statement January 2018	No comments on the proposed methodology received.	No action required.
Natural England	Norfolk Boreas Onshore Ecology and Ornithology Method Statement January 2018	Natural England agree that surveys should be undertaken this year [2018] to fill in any data gaps (providing access is available) and to consolidate existing ecological information.	Additional baseline data collected in spring 2018 is presented in section 22.7. Baseline data collection in 2018 is still ongoing, and full data will be presented in the ES.
Natural England	Norfolk Boreas Onshore Ecology and Ornithology Method Statement January 2018	<p>We query definition of some of the low value habitats:</p> <p>Low value receptors are stated as being as follows:</p> <ul style="list-style-type: none"> • Network of inter-connected hedgerows including some species-rich hedgerows; • Other features identified as wildlife corridors or migration routes. <p>Natural England query the definition of the receptors above, i.e. the wildlife corridor/mitigation routes, such as hedgerows, as these may be key supporting habitat for designated site features, such as bats. We advise that these receptors are given further consideration and/or that further justification to their assignment of low value needs to be provided.</p>	These habitats have been assigned a 'low' importance in accordance with the CIEEM guidelines (2018) to account for the value of habitat networks which are not of greater value due to being confirmed to support a notable or legal protected species. For example, a hedgerow which is confirmed as supporting commuting or foraging bats will be categorised as a habitat of high importance. By giving these habitat networks a low value (and not no value) their

Consultee	Document / Date	Comment	Response / where addressed in the ES
			importance outside of the legal protected and notable habitat and species has been included within the assessment.
Norfolk County Council	Norfolk Boreas Onshore Ecology and Ornithology Method Statement January 2018	2017 bat activity surveys have not been made available to date. Given the previously identified issues around data collection and methodology changes during the season, we feel unable to make a comment on their appropriateness at this stage. At the Vanguard ETG meeting earlier this month, I also asked questions around barbastelle bat roosts close to Paston Barn SAC and suggested if the barbastelles using these roosts should be considered as part of the Paston SAC population.	The final bat survey report was presented within the Norfolk Vanguard ES at Appendix 22.5. Comments on the final data collected would be welcomed. Please note that further bat activity survey data is being collected during summer 2018.
Natural England	PEIR October 2018	Ongoing issues for Vanguard Terrestrial Ecology: <ul style="list-style-type: none"> • River Wensum SAC – further information required • Paston Great Barn SAC – further information required • Norfolk Valley Fens SAC – further information required 	Issues raised in relation to the Norfolk Vanguard HRA have been considered within the Norfolk Boreas HRA. The findings of the Norfolk Boreas HRA are summarised in section 22.7.
The Forestry Commission	PEIR October 2018	We are aware that the proposers have used the Horlock Rules and that the route endeavours to avoid passing through ancient woodland and other woodland and trees. However, there are places where it skirts the boundaries of ancient woodland and consideration of potential impacts of the cabling process also needs to be considered and any mitigations measures which might be required at certain locations. We have looked at the PIER (<i>sic</i>) and see quite a lot about landscape impact, but not so much about physical impact on the ancient woodlands which we acknowledge are few on the route.	The onshore project area will stay at least 15m from all ancient woodlands, as per Forestry Commission guidance (Natural England and Forestry Commission, 2014). Potential impacts upon ancient woodlands are considered in section 22.7.
The Forestry Commission	PEIR October 2018	Little Wood to the North West of Dereham Map 19 and 20 of 22 does appear to be impacted, the route runs through the southern edge between Little	Route selection at Little Wood / Old Carr has been undertaken to specifically avoid

Consultee	Document / Date	Comment	Response / where addressed in the ES
		<p>Wood and Old Carr, however any damage to this small area of ancient woodland may make it unviable, a better option would be to move the route to the north of the wood, on the map it doesn't appear to require much of a re-route, this would mean that the two woods could be buffered at some future date to offer greater climate change resilience. The Standing Advice provides detail on considerations such as impact of noise, dust, changes to water table to name three, any buffering with new plantings might help mitigate this prior to commencement of construction Whilst Necton Great Wood appears far enough away from the sub-station development (500metres) to suffer few impacts there is an opportunity to link the smaller woods nearby with some judicious planting this would provide some wildlife corridors as well as screening. We have not examined any mitigation proposals associated with this scheme only what is in the PIER.</p>	<p>ancient woodland. In this location, as there was no viable alternative route available, the project intends to use trenchless techniques to install the cable beneath these ancient woodlands. Potential impacts on ancient woodland is considered in section 22.7.</p>
<p>Norfolk County Council</p>	<p>PEIR October 2018</p>	<p>The ecological baseline information provided in Chapter 22 of the PEIR for the Boreas project is essentially the same as that in the PEIR and DCO submission for the sister Vanguard project, although some additional ecological surveys are described that were undertaken in 2018. The Natural Environment Team are supportive of the approach taken with regards to ecology and agree the baseline data presented in the current PEIR is appropriate. It is noted that in some locations, survey access was not possible in either 2017 or 2018, and surveys in these areas will be required in due course. As with the Vanguard project, some mitigation for ecology is embedded through design (summarised in Tables 22.22 and 22.23 of Chapter 22 of the PEIR) and some will be achieved through the Outline Landscape and Ecological Management Plan which will be submitted with the DCO submission. We are supportive of this approach.</p>	<p>No action required.</p>

Consultee	Document / Date	Comment	Response / where addressed in the ES
Environment Agency	PEIR October 2018	<p>22.2.3.3 A Green Future: Our 25 Year Plan to Improve the Environment 2018 This has been incorporated into many elements of the project however it should also be extended to achieving ‘net gain’ in priority habitat rather than just an aspiration to avoid net loss. For example, additional pollinator corridors could be planted to link other habitat in the ecological network which is aligned with the National Pollinator Strategy.</p> <p>Other options could involve partnership with the EA on the River Wensum restoration project. This is an ongoing project to restore the River Wensum SSSI/ SAC/ SPA. This could include floodplain reconnection, installation of woody debris, creation of berms and tree planting.</p> <p>Enhancements such as these will help ensure that there is no net loss of biodiversity and contribute to the government’s target of leaving the environment in a better state than when we found it.</p>	River enhancements at water crossing locations are discussed within Chapter 20 Water Resources and Flood Risk, and summarised in section 22.7.
Environment Agency	PEIR October 2018	<p>22.7.5.17: Impact 17: Fish</p> <p>If using open-cut trenching at Reepham Stream and Booton Watercourse, we would like to see riverine habitat improvements (such as installing gravel riffles or shallow bays) used in conjunction with the existing mitigation plan listed for brown trout and bullhead. These improvements could potentially create new or improve the existing spawning habitat, providing a net gain for biodiversity.</p>	River enhancements at water crossing locations are discussed within Chapter 20 Water Resources and Flood Risk, and summarised in section 22.7.
Environment Agency / Natural England	February 2019 ETG Minutes	‘Net gain’ may be an area where NE stance varies from Norfolk Vanguard and something they would be looking at for large NSIP projects to achieve, especially in relation to bats.	Habitat enhancements associated with the project are set out in section 22.7.

22.4 Assessment Methodology

22.4.1 Impact Assessment Methodology

43. Chapter 6 EIA Methodology details the general impact assessment method. The following sections describe more specifically the EclA methodology proposed in relation to onshore ecology that is based on the Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine (CIEEM, 2018). The methodology was consulted on and agreed via stakeholder review of the Onshore Ecology and Ornithology Method Statement (Royal HaskoningDHV, 2018, unpublished) (with Natural England, the Environment Agency, Norfolk County Council, Norfolk Wildlife Trust, North Norfolk District Council and Breckland Council) and the Scoping Report (Royal HaskoningDHV, 2017).
44. The CIEEM guidelines aim to predict the residual impacts on important ecological features affected, either directly or indirectly by a development, once all the appropriate mitigation has been implemented.
45. The approach to determining the significance of an impact follows a systematic process for all impacts. This involves identifying, qualifying and, where possible, quantifying the sensitivity, value and magnitude of all ecological receptors which have been scoped into this assessment. Using this information, a significance of each potential impact has been determined. Each of these steps is set out in the remainder of this section.
46. The EclA has used professional judgement to ensure the assessed significance level is appropriate for each individual receptor, taking account of local values for biodiversity to avoid a subjective assessment wherever possible as per the CIEEM guidelines. As a result, the assessed significance level may not always be directly attributed to the guidance matrix detailed below.

22.4.1.1 Importance

47. The first stage of an EclA is determining the importance of ecological features or receptors. CIEEM identifies the important ecological features as those key sites, habitats and species which have been identified by European, national and local governments and specialist organisations as a key focus for biodiversity conservation in the UK. These include:
 - Statutory and non-statutory designated sites for nature conservation;
 - Species occurring on national biodiversity lists;
 - UK Habitats of Principal Importance; and
 - Red listed, rare or legally protected species.

48. Importance is also qualified by the geographic context of an ecological receptor, i.e. a species which may be not recognised on a national biodiversity list may be locally in decline, and therefore its local importance is greater than its national importance.
49. For this EclA, the guidelines outlined in Table 22.4 have been followed to provide the relative importance of different ecological features.

Table 22.4 Definitions of importance levels for onshore ecology

Importance	Definition
High	<ul style="list-style-type: none"> • An internationally designated site or candidate site or an area which the statutory nature conservation organisation has determined meets the published selection criteria for such designation, irrespective of whether or not it has yet been notified; • A nationally designated site or a discrete area, including ancient woodlands, which the statutory nature conservation organisation has determined meets the published selection criteria for national designation (e.g. SSSI selection guidelines) irrespective of whether or not it has yet been notified; • A viable area of a habitat type listed in Annex I of the Habitats Directive, or smaller areas of such habitat which are essential to maintain the viability of a larger whole; • A viable area of a UK Habitat of Principal Importance or smaller areas of such habitat which are essential to maintain the viability of a larger whole; • A European protected species listed in The Conservation of Habitats and Species Regulations 2017; or • A regularly occurring, nationally significant population / number of any internationally important species.
Medium	<ul style="list-style-type: none"> • County Council / Unitary Authority designated sites and other sites which the designating authority has determined meet the published ecological selection criteria for designation, including Local Nature Reserves selected on defined ecological criteria and Wildlife Trust sites; • Viable areas of habitat identified in a Local Biodiversity Action Plan (LBAP); • Semi-natural woodland greater than 0.5 hectares (ha) which is considered to be in 'good condition'; • Any regularly occurring population of a nationally important species which is threatened or rare in the region; or • A regularly occurring, locally significant number of a species identified as important on a regional basis.
Low	<ul style="list-style-type: none"> • Semi-natural woodland greater than 0.25ha which is considered to be in 'good condition' or greater than 0.5ha in unfavourable condition; • Network of inter-connected hedgerows including some species-rich hedgerows; • Individual Important hedgerows or other ancient-countryside linear features; • Viable areas of habitat identified in a sub-county (District / Borough) BAP; • Any regularly occurring population of a nationally important species which is not threatened or rare in the region or county; • Sites / features that are scarce within the District / Borough or which appreciably enrich the District / Borough habitat resource; or • Other features identified as wildlife corridors or migration routes.
Negligible	<ul style="list-style-type: none"> • Features of value to the immediate area only e.g. within the site.

50. In addition to the features listed in Table 22.4, ecological features which play a key functional role in the landscape or are locally rare have been considered. The importance of such features has been determined using professional judgement.
51. CIEEM places the emphasis on using professional judgement when considering the importance of ecological receptors, based on available guidance, information and expert advice (CIEEM, 2016). Different aspects of ecological importance should be taken into account, including designations, biodiversity value, potential value, secondary or supporting value, social value, economic value, legal protection and multi-functional features.

22.4.1.2 Magnitude

52. The magnitude of the impact is assessed according to:
- The extent of the area subject to a predicted impact;
 - The duration the impact is expected to last prior to recovery or replacement of the resource or feature;
 - Whether the impact is reversible, with recovery through natural or spontaneous regeneration, or through the implementation of mitigation measures or irreversible, when no recovery is possible within a reasonable timescale or there is no intention to reverse the impact; and
 - The timing and frequency of the impact, i.e. conflicting with critical seasons or increasing impact through repetition.
53. Table 22.5 summarises the definitions of magnitude that have been used for the onshore ecology receptors.

Table 22.5 Definitions of magnitude levels for onshore ecology

Magnitude	Definition
High	Major impacts on the feature / population, which would have a sufficient effect to alter the nature of the feature in the short to long term and affect its long-term viability. For example, more than 20% habitat loss or damage.
Medium	Impacts that are detectable in short and long-term, but which should not alter the long-term viability of the feature / population. For example, between 10 - 20% habitat loss or damage.
Low	Minor impacts, either of sufficiently small-scale or of short duration to cause no long-term harm to the feature / population. For example, less than 10% habitat loss or damage.
Negligible / No change	A potential impact that is not expected to affect the feature / population in any way, therefore no effects are predicted.

22.4.1.2.1 Duration

54. The definitions of duration used within this EclA are dependent on the individual ecological receptor, and how sensitive it is to effects over different timescales. However, in general terms the following definitions have been used:

- **Short term** – effects which at most occur over a part of – or over a part of a key period of – a species’ active season or a habitat’s growing season, i.e. typically effects which occur over a matter of days or weeks;
- **Medium term** – effects which occur over the full duration of a species’ active season or a habitat’s growing season, i.e. typically effects which occur over a matter of months or one year; and
- **Long term** – effects which occur over the multiple active or growing seasons, i.e. typically effects which occur over more than one year.

55. Where deviations from these definitions are used within section 22.7 this is explained within the text.

22.4.1.3 Impact significance

56. Following the identification of receptor importance and magnitude of the effect, it is possible to determine the significance of the impact.

57. Ecologically significant impacts are defined as:

- ‘...impacts on structure and function of defined sites, habitats or ecosystems and the conservation status of habitats and species (including extent, abundance and distribution)’ (CIEEM, 2018).

58. Impacts are unlikely to be significant where features of low importance are subject to small scale or short-term effects. If an impact is found not to be significant at the level at which the resource or feature has been valued, it may be significant at a more local level.

59. CIEEM recommend that the following factors are taken into account when determining significance for selected ecological receptors.

22.4.1.3.1 Designated/defined sites and ecosystems

- **Designated sites** – is the project and associated activities likely to undermine the site’s conservation objectives, or positively or negatively affect the conservation status of species or habitats for which the site is designated, or may it have positive or negative effects on the condition of the site or its interest/qualifying features?
- **Ecosystems** – is the project likely to result in a change in ecosystem structure and function?

22.4.1.3.2 Habitats and species

- **Habitats** – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area; and

- **Species** – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area (CIEEM, 2018).
60. Following the identification of receptor importance and magnitude of effect, the significance of the impact has been considered using the matrix presented in Table 22.6 below and knowledge of the ecological features affected.
61. The assessment of potential impacts has been undertaken assuming that all embedded mitigation and project decisions made during the design process to minimise impacts will be successfully implemented. Where, following this assessment, significant impacts are identified, additional mitigation measures are then proposed. This is the general approach, however there are exceptions to this, for example where a specific mitigation has been recommended by a stakeholder which may provide a benefit but does not reduce the impact to a lower category. A final assessment of the residual impacts remaining following implementation of these additional mitigation measures is then made.

Table 22.6 Impact significance matrix

	Negative magnitude				Beneficial magnitude				
	High	Medium	Low	Negligible	Negligible	Low	Medium	High	
Importance	High	Major	Major	Moderate	Minor	Minor	Moderate	Major	Major
	Medium	Major	Moderate	Minor	Minor	Minor	Minor	Moderate	Major
	Low	Moderate	Minor	Minor	Negligible	Negligible	Minor	Minor	Moderate
	Negligible	Minor	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible	Minor

62. The impact significance categories are defined as shown in Table 22.7.

Table 22.7 Impact significance definitions

Impact Significance	Definition
Major	Very large or large change in receptor condition, both adverse or beneficial, which are likely to be important considerations at a regional or district level because they contribute to achieving national, regional or local objectives, or, could result in exceedance of statutory objectives and / or breaches of legislation.
Moderate	Intermediate change in receptor condition, which are likely to be important considerations at a local level.
Minor	Small change in receptor condition, which may be raised as local issues but are unlikely to be important in the decision making process.
Negligible	No discernible change in receptor condition.

Impact Significance	Definition
No impact	No impact, therefore no change in receptor condition.

63. Note that for the purposes of this EclA, major and moderate impacts are considered to be significant. In addition, whilst minor impacts are not significant in their own right, it is important to distinguish these from other non-significant impacts as they may contribute to significant impacts cumulatively or through interactions.

64. Embedded mitigation has been referred to and included in the initial assessment of impact. If the impact does not require mitigation (or none is possible) the residual impact remains the same. If, however, mitigation is required an assessment of the post-mitigation residual impact is provided.

22.4.1.4 Approach to predicting impacts for unsurveyed areas

65. For all unsurveyed areas where potential impacts have been identified, post-consent ecological surveys will be required. Full details of these requirements are provided for each receptor within section 22.7.

66. Please see section 22.5.3 for a full assessment of the coverage and quality of the data used to inform the ecological baseline presented within this EclA.

22.4.2 Cumulative Impact Assessment

67. Chapter 6 EIA Methodology provides a general methodology with regards to the CIA. This chapter includes those cumulative impacts that are specific to onshore ecology.

68. The key consideration used in relation to linear development such as the onshore project area is whether there is spatial or temporal overlap of effects from multiple projects on the same receptors. Therefore, for habitats and non-mobile species, unless there is a spatial overlap there is no pathway for cumulative impact between spatially separated projects. There is however potential for a cumulative impact upon the overall habitat resource at a regional or national level. Where potential regional or national level impacts are identified and considered to be relevant they are highlighted in the CIA.

69. For mobile species there is only a pathway for cumulative impact if there is spatial overlap of potential receptor ranges and a temporal overlap with the activity or its resultant impact i.e. where developments follow on from one another before the species has recovered from displacement or other impact. In addition, whilst it is assumed that any consented development would be subject to mitigation and management measures which would reduce impacts to non-significant unless there were exceptional circumstances, it is accepted that such projects may contribute to a wider cumulative impact.

70. Finally, in cases where this project has negligible or no impact on a receptor (through for example avoidance of impact through routeing or construction methodology) it is considered that there is no pathway for a cumulative impact.
71. Further details of the methods used for the CIA for onshore ecology are provided in section 22.8 .

22.4.3 Transboundary Impact Assessment

72. There are no transboundary impacts with regards to onshore ecology as the proposed onshore project area works is not sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and will not be considered further.

22.4.4 Habitats Regulations Assessment

73. A Habitats Regulations Assessment (HRA) Report (document reference 5.3) has been prepared for the project and has been submitted as part of the DCO application. The HRA Report contains an assessment of whether or not the project will have an adverse effect upon the integrity of a European site (i.e. SPA, SAC or Ramsar sites), either alone or in combination with other projects.
74. This chapter draws on the information provided and assessed within the HRA Report where relevant to do so, i.e. where potential impacts upon ecological receptors which are associated with European sites and their qualifying features have been identified. For more details regarding the HRA assessment, please refer to the HRA Report (document reference 5.3) submitted alongside the ES as part of the DCO application.

22.5 Scope

22.5.1 Study Area

75. The onshore development footprint is referred to hereafter as the onshore project area and is shown on Figure 22.1. The onshore infrastructure considered within this assessment includes the following elements:
 - Scenario 1:
 - Landfall;
 - Cable pulling through pre-installed ducts;
 - Onshore project substation;
 - Extension to the Necton National Grid substation; and
 - Landscape and planting schemes.
 - Scenario 2:

- Landfall;
- Duct installation including trenchless crossing (e.g. HDD) and mobilisation areas;
- Cable pulling;
- Onshore project substation;
- Extension to the Necton National Grid substation;
- Overhead line modifications at Necton National Grid substation; and
- Landscape and planting schemes.

76. The onshore infrastructure is set out in full detail in Chapter 5 Project Description.

77. The study areas for specific onshore ecological receptors used in this EclA are provided in Table 22.8. Different study areas have been used for different receptors depending on their sensitivity and on their habitat preferences. These study areas were selected according to standard guidance and professional judgement. All study areas presented below have been discussed and agreed with stakeholders as part of the Norfolk Boreas EPP.

Table 22.8 Study areas for different onshore ecology receptors used for this EclA

Data / survey	Study area	Study area name used in the remainder of this document
Statutory designated sites	Within 2km of the onshore project area (Figure 22.2).	'designated site study area'
Statutory designated sites located	Within 200m of site access routes which exceed set air quality criteria (Figure 26.1, Chapter 26 Air Quality)	'construction vehicle exhaust emissions study area'
Non-statutory designated sites	Within 2km of the onshore project area (Figure 22.3).	'designated site study area'
UKHPI and Norfolk LBAP Habitats	Within 50m of the onshore project area (Figure 22.5).	'habitats and species study area'
Protected and notable species (except great crested newts <i>Triturus cristatus</i>)	Within 50m of the onshore project area (Figure 22.5).	'habitats and species study area'
Great crested newts	Within 250m of the temporary ¹ onshore project area and within 500m of the permanent onshore project area (Figure 22.6).	'great crested newt study area'

22.5.2 Data Sources

78. This EclA has been informed by desk-based information and field survey data collected with respect to Norfolk Vanguard. As the majority of the onshore project

¹ 'Temporary onshore project area' includes the landfall and onshore cable route works; 'permanent onshore project area' includes the onshore project substation and Necton National Grid substation extension.

areas for both projects cover the same footprint, the data collected as part of the Norfolk Vanguard project has been used to characterise the baseline for the project and in turn used to inform this EclA. This approach has been discussed and agreed in consultation with Natural England and Norfolk County Council (see section 22.3).

79. Baseline survey data was collected from July 2016 onwards, with the field survey data collection programme completed by the end of October 2017. The suitability of this data for characterising the baseline environment was discussed and agreed with Natural England as part of the EPP (see section 22.3). This data has been collected for the appropriate study areas for the receptor concerned and based upon the project information available at the time of collection.
80. The data sources used to inform the EclA are summarised in Table 22.9.
81. In addition to the baseline data collected in 2016, a further field survey programme was undertaken in 2018, the scope of which was outlined in the Onshore Ecology and Onshore Ornithology Method Statement (Royal HaskoningDHV, 2018, unpublished). This additional survey effort was designed to provide targeted data to cover selected gaps in the existing baseline data for the study areas. Using aerial photography and Living Map data, 15 areas (termed 'priority areas') for further survey were identified within the unsurveyed sections of the onshore project area.
82. The priority areas were identified as being either potentially important ecological areas due to their proximity to designated sites (e.g. the River Wensum) or sensitive habitats (e.g. woodlands, watercourses, etc.), or the locations of more complex infrastructure (e.g. HDD compounds). The scoping process for identifying these priority areas is explained in full in Appendix 22.1 Extended Phase 1 Habitat Survey Reports. An Extended Phase 1 Habitat Survey followed by species-specific surveys (where relevant) were undertaken at each of the priority areas. The 2018 field survey programme was undertaken between February and October 2018 (see Table 22.9 for details).

Table 22.9 Data sources

Data source	Date	Data contents	Coverage	Status
Desk study data				
JNCC	July 2016 (updated March 2018)	European designated sites (SPA, SAC, Ramsar sites)	Onshore project area plus a 2km buffer	Data obtained
JNCC Natural England	July 2016 (updated March 2018)	UK designated sites (SSSI, NNR, LNR, Ancient Woodland)	Onshore project area plus a 2km buffer	Data obtained
JNCC	July 2016 (updated March 2018)	UK Habitats of Principal Importance	Onshore project area plus a 50m buffer	Data obtained
Norfolk Biodiversity Information Service (NBIS)	July 2016	Locally designated sites (CWS, Roadside Nature Reserves (RNR))	Onshore project area plus a 2km buffer	Data obtained
NBIS	July 2016	Protected and notable species records including: <ul style="list-style-type: none"> • Wildlife & Countryside Act 1981 Schedules 1,5, 8 & 9; • The Conservation of Habitats & Species Regulations 2017 Schedules 2 & 5; • Protection of Badgers Act 1992; • Bonn Convention Appendix 1 & 2; • Bern Convention Annex 1 & 2; • Habitats Directive Annex 2, 4 & 5; • NERC Act 2006 Section 41 species; • UK BAP species (both local and national); 	Onshore project area plus a 2km buffer (5km for bats)	Data obtained

Data source	Date	Data contents	Coverage	Status
		<ul style="list-style-type: none"> • Veteran trees²; IUCN Red List Species; • Nationally Notable species; • Locally Rare species. 		
APEM	March 2017	High-resolution aerial photography data	Onshore project area plus a 50m buffer	Data obtained
NBIS	March 2017	Norfolk 'Living Map' remote sensing habitat mapping data	Onshore project area plus a 50m buffer	Data obtained
Norfolk Barbastelle Study Group	June 2017 <i>(further clarification on data provided January 2018)</i>	<p>Barbastelles <i>Barbastella barbastellus</i>:</p> <ul style="list-style-type: none"> • Radiotracking data for maternity colonies, to show roost locations and home ranges; • Barbastelle roosts (summer and winter), commuting routes (at hedgerow level as far as possible), core foraging areas; • Additional acoustic data for later summer/autumn. <p>Other bat species:</p> <ul style="list-style-type: none"> • Roosts, species, type and counts; and • Acoustic records. 	<p>Radiotracking data and other species roost data: Onshore project area plus a 5km buffer</p> <p>Commuting routes and acoustic data: onshore project area plus 50m buffer</p>	Data obtained
Norfolk LBAP	June 2017	Lists of Norfolk priority habitat and species. Information on Norfolk's ecological networks.	Onshore project area plus a 50m buffer	Data obtained
NWT	July 2017	Management Statement for Kerdiston Old Hall Meadows	Site-specific information	Data obtained
Environment Agency	March 2018	<p>Records of:</p> <ul style="list-style-type: none"> • Crayfish (all species); • Fish species from the National Fish Population Database <p>Details of river restoration works at Wendling Beck.</p>	Watercourses in the Wensum and Bure catchments within the onshore project area plus a 50m buffer	Data obtained

² Veteran trees are not precisely defined (Forestry Commission, 2018), however the criteria set out in *Veteran Trees: A guide to good management* (Natural England, 2000) has been used here.

Data source	Date	Data contents	Coverage	Status
Field survey data				
2017 Extended Phase 1 Habitat Survey	February 2017	<p>An Extended Phase 1 Habitat Survey following 'Extended Phase 1' methodology as set out in <i>Guidelines for Baseline Ecological Assessment</i> (Institute of Environmental Assessment (IEMA), 1995). Habitats were classified and mapped following JNCC's <i>Handbook for Phase 1 habitat survey: A technique for environmental audit</i> (2010).</p> <p>Included a search for:</p> <ul style="list-style-type: none"> • Field signs of badgers; • Assessment of roost suitable of trees and structures for bats; • Assessment of commuting / foraging suitability of all linear features for bats; • Field signs of otter <i>Lutra lutra</i>; • Assessment of suitability of watercourse to support water voles <i>Arvicola amphibius</i>; • Habitats suitability assessment of all standing water bodies for ability to support great crested newts; • Assessment of suitability of habitats to support reptiles; • Assessment of suitability of habitats to notable invertebrates; and • Evidence of non-native invasive species. 	<p>Great crested newts: Onshore project area plus 250m buffer (temporary works) and 500m buffer (permanent works)</p> <p>All other habitats and species: Onshore project area plus a 50m buffer</p> <p>Coverage of approx. 50% of survey area.</p>	Full survey results available
2017 Great Crested Newt Survey	March-June 2017	A great crested newt presence / likely absence survey of those standing water bodies identified during the Extended Phase 1 Habitat Survey as providing 'average', 'good' or 'excellent' habitat suitability to supporting breeding populations of great crested newts.	<p>Onshore project area plus a 250m (temporary works) and 500m (permanent works) buffer</p> <p>Coverage of approx. 30% of survey area.</p>	Full survey results available
2017 Water Vole Survey	May-June 2017	A water vole presence / absence and population estimate survey of those watercourses identified as suitable to support water voles during the Extended Phase 1 Habitat Survey. Field signs of otters were also searched for during this survey.	<p>Onshore project area plus a 50m buffer</p> <p>Coverage of approx. 50% of survey area.</p>	Full survey results available

Data source	Date	Data contents	Coverage	Status
2017 Reptile Presence/ Absence Survey	April-September 2017	A reptile presence / absence survey of all habitat mosaics identified during the Extended Phase 1 Habitat Survey as providing suitable habitat for common reptile species.	Onshore project area plus a 50m buffer	Full survey results available
2017 Bat Emergence / Re-entry Surveys	April - October 2017	Bat emergence / re-entry surveys of all trees and structures identified during the Extended Phase 1 Habitat Survey as providing moderate or high suitability to support roosting bats.	Onshore project area plus a 50m buffer	Full survey results available
2017 Bat Activity Surveys	May - October 2017	Bat activity surveys of all linear features (hedgerows, watercourses scrub patches and woodland edges, coastline) identified during the Extended Phase 1 Habitat Survey as providing moderate or high suitability to support commuting or foraging bats.	Onshore project area plus a 50m buffer	Full survey results available
2017 Desmoulin's whorl snail Survey	July 2017	A survey for the Desmoulin's whorl snail within floodplain habitats adjacent to the River Wensum.	Floodplain habitats of the River Wensum	Full survey results available
2017 <i>Odonata</i> Transect Survey	July 2017	A transect survey for the Norfolk hawkler (adult stage) along drainage ditches adjacent to the River Bure.	Drainage ditches of the River Bure floodplain	Full survey results available
2017 Botanical National Vegetation Classification (NVC) Survey	July 2017	A NVC survey searching for the qualifying flora species (Stream water-crowfoot <i>R. penicillatus</i> ssp. <i>Pseudofluitans</i> , thread-leaved water-crowfoot <i>R. trichophyllus</i> and fan-leaved water-crowfoot <i>R. circinatus</i>) of the River Wensum SAC.	Floodplain habitats of the River Wensum	Full survey results available
2018 Extended Phase 1 Habitat Survey	February 2018	An Extended Phase 1 Habitat Survey following 'Extended Phase 1' methodology as set out in <i>Guidelines for Baseline Ecological Assessment</i> (Institute of Environmental Assessment, 1995). Habitats were classified and mapped following JNCC's <i>Handbook for Phase 1 habitat survey: A technique for environmental audit</i> (2010). Included a search for: <ul style="list-style-type: none"> • Field signs of badgers; • Assessment of roost suitable of trees and structures for bats; 	15 'priority areas' located within the onshore infrastructure (plus a 50m buffer) for which data was not obtained in 2017. 2017 and 2018 surveys achieved a combined	Full survey results available

Data source	Date	Data contents	Coverage	Status
		<ul style="list-style-type: none"> • Assessment of commuting / foraging suitability of all linear features for bats; • Field signs of otter; • Assessment of suitability of watercourse to support water voles; • Habitats suitability assessment of all standing water bodies for ability to support great crested newts; • Assessment of suitability of habitats to support reptiles; • Assessment of suitability of habitats to notable invertebrates; and • Evidence of non-native invasive species. 	coverage of approx. 65% of survey area.	
2018 Great Crested Newt Survey	March-June 2018	A great crested newt presence / likely absence survey of those standing water bodies identified during the 2018 Extended Phase 1 Habitat Survey as providing 'average', 'good' or 'excellent' habitat suitability to supporting breeding populations of great crested newts located within the onshore project area.	All unsurveyed water bodies located within the onshore project area plus a 250m (temporary works) and 500m (permanent works) buffer 2017 and 2018 surveys achieved a combined coverage of coverage of approx. 45% of the great crested newt study area.	Full survey results available
2018 Water Vole Survey	May-June 2018	A water vole presence / absence and population estimate survey of those watercourses identified as suitable to support water voles during the 2018 Extended Phase 1 Habitat Survey. Field signs of otters were also searched for during this survey.	All watercourses located within the 15 'priority areas' 2017 and 2018 surveys achieved a combined coverage of approx. 65% of survey area.	Full survey results available
2018 Reptile Presence/Absence Survey	April-September 2018	A reptile presence / absence survey of all habitat mosaics identified during the 2018 Extended Phase 1 Habitat Survey as providing suitable habitat for common reptile species.	All suitable habitats located within the 15 'priority areas'	Full survey results available

Data source	Date	Data contents	Coverage	Status
			Onshore project area plus a 50m buffer	
2018 Bat Emergence / Re-entry Surveys	April - October 2018	Bat emergence / re-entry surveys of all trees and structures identified during the 2018 Extended Phase 1 Habitat Survey as providing moderate or high suitability to support roosting bats.	All suitable habitats located within the 15 'priority areas' Onshore project area plus a 50m buffer	Full survey results available
2018 Bat Activity Surveys	May - October 2018	Bat activity surveys of all linear features (hedgerows, watercourses scrub patches and woodland edges, coastline) identified during the 2018 Extended Phase 1 Habitat Survey as providing moderate or high suitability to support commuting or foraging bats.	All suitable habitats located within the 15 'priority areas' Onshore project area plus a 50m buffer	Full survey results available
2018 Desmoulin's whorl snail Survey	August 2018	A survey for the Desmoulin's whorl snail within floodplain habitats adjacent to the River Wensum not surveyed in 2017.	Floodplain habitats of the River Wensum unsurveyed in 2017	Full survey results available
2018 Botanical NVC Survey	July 2018	A NVC survey searching for the qualifying flora species (Stream water-crowfoot <i>R. penicillatus</i> ssp. <i>Pseudofluitans</i> , thread-leaved water-crowfoot <i>R. trichophyllus</i> and fan-leaved water-crowfoot <i>R. circinatus</i>) of the River Wensum SAC not surveyed in 2017.	Floodplain habitats of the River Wensum unsurveyed in 2017	Full survey results available

22.5.3 Assumptions and Limitations

83. Biological records data provided by NBIS includes records collected by members of the public and volunteers, and therefore these are not necessarily subject to quality control or necessarily contain full details of, or spatially accurate information for, the species recorded. The absence of records does not imply any species, habitat or designation is absent from the search area. Nor does recorded presence imply current, continuing or breeding presence. Despite these caveats, biological records provide very useful supporting data to provide context when field survey data is not available.
84. No accuracy assessment has been carried out on the Norfolk Living Map by NBIS, and it is anticipated that there may be errors in the data, for example where there was cloud cover in the remote sensing imagery, or shadow caused by steep gulleys or on north-facing slopes. However, such errors are likely to be systematic and as such it has been possible to check the Living Map habitat classification against the field survey data and to identify which habitat types have been misidentified. One example is the wet grassland in Wendling Carr, which has been incorrectly identified as Lowland Mixed Deciduous Woodland, likely due to the presence of a small number of scattered trees. Such errors have been identified during the production of the Extended Phase 1 Habitat Survey maps and therefore minimised as far as possible.
85. The field surveys which have been undertaken to inform this EclA have been undertaken during the 2017 and 2018 ecological survey season. As the project is yet to receive consent, landowner agreement is an ongoing process and as such landowner access to undertake field surveys is dependent on permission being granted by individual landowners. Full landowner access has not been possible during the 2017 and 2018 field surveys. Access has been possible to approximately 65% of the field survey study area (the onshore infrastructure plus a 50m buffer). The Norfolk Living Map data provided by NBIS has been used to characterise the habitats for the remaining 35% of the study area, and other desk study data (e.g. Norfolk Barbastelle Study Group barbastelle radio-tracking data) has been used to provide other information for species where possible.
86. For the purposes of this EclA, and for areas where survey data is not available due to access restrictions, a precautionary approach has been adopted, i.e. it has been assumed that protected or notable species will be present within these unsurveyed areas. In these instances, an assessment of the habitat and its suitability to support protected or notable species has been made using either the findings from the 2017 and 2018 Extended Phase 1 Habitat Surveys or from reviewing the Norfolk Living Map data. Where surveys have not been possible due to the lack of landowner

access, full surveys of these areas will be carried out post-consent and prior to the commencement of construction activities.

87. Some habitats could not be fully accessed during the field surveys due to physical barriers preventing entry, for example complex field drain networks or dense scrub. However, these areas were encountered infrequently and, where they were, they were recorded and it was noted that the presence of field signs within these areas could not be ruled out.
88. To ensure surveys could be conducted with sufficient lead-in time to inform this assessment, the Extended Phase 1 Habitat Surveys were undertaken during February 2017 and early March 2017, and during February 2018, which is outside of the optimal survey period for identifying ground flora species and hence habitat communities. Despite this, sufficient evidence was found during the survey to successfully identify habitat communities, and a number of early season plant species were able to be identified. In order to ensure that rare plant species which may be present during the summer period were not overlooked, where sensitive habitats were identified, further targeted botanical surveys were recommended and were subsequently undertaken in the summer months of 2017 and 2018 within the optimum surveying window for plant species.
89. The survey team made the utmost effort to cover every habitat and record all field signs present during the 2017 and 2018 field surveys carefully following the relevant established methodology, although it is not possible to rule out the potential that some field signs can be missed or overlooked due to human error. The data presented in Appendices 22.1 – 22.9 and summarised in section 22.6 is considered to provide an accurate description of the habitats and accurate account of species presence / absence within the survey area.
90. The one exception to this is the Norfolk hawker dragonfly survey (Appendix 22.9). It is acknowledged that although the results gathered within the survey report are useful, they do not meet the British Dragonfly Society criteria for establishing breeding presence (i.e. evidence of a copulating pair of dragonflies, females ovipositing, or the presence of a larva, exuvia or teneral individuals at the water body (BDS, 2015)). However following route refinements, the suitable habitats for Norfolk hawker dragonfly identified at the River Bure are no longer located within the onshore project area. If there is any risk to this species arising from any changes to the project, further survey(s) will be undertaken to determine whether breeding is taking place.
91. Despite the survey limitations described, the data collected is sufficient to identify the nature and scale of impacts likely to arise as a result of the project in order to produce a robust EclA. Where there are gaps in the data collected due to landowner

access restrictions, impenetrable habitat or other restrictions, by using detailed desk study data where available (e.g. using the Norfolk Living Map) and by assuming that species are present within these unsurveyed areas the EclA presented in this chapter ensures that a ‘worst case’ assessment of impacts upon ecological receptors has been adequately undertaken.

22.6 Existing Environment

22.6.1 Statutory Designated Sites

92. A total of 37³ statutory designated sites for nature conservation are located within the designated sites study area (Figure 22.2). These are:
- Two SACs / SSSIs;
 - One NNR / SSSI;
 - 10 other SSSIs (including to the three referred to above);
 - Three LNRs; and
 - 20 ancient woodlands.
93. One of these sites, the River Wensum SAC and SSSI, is also located directly within the onshore project area.
94. A further SSSI (Happisburgh Cliffs) is designated for its geological features only and is not considered further in this chapter. Due to its geological designation, this SSSI is considered in Chapter 19 Ground Conditions and Contamination.
95. Table 22.10 lists the 37 statutory designated sites that are located within the designated sites study area. Table 22.10 also provides a summary of the qualifying features/reasons for notification of these designated sites. The legislation underpinning statutory designated sites is discussed in section 22.2.1. The locations of these statutory designated sites are also shown on Figure 22.2.
96. In addition to these sites, Chapter 26 Air Quality identified eight statutory designated sites for nature conservation which have been scoped into the construction vehicle emissions study area (see Figure 26.3). These sites are shown in Table 26.20 Chapter 26 Air Quality.
97. All statutory designated sites for nature conservation are considered to be of high importance.

³ Following consultation with Natural England as part of the Norfolk Vanguard EPP in March 2018, the HRA Report for Norfolk Boreas (Document reference 5.3) has screened in a further designated site, The Broads SAC (Broad Fen, Dilham component SSSI). This site is located 3.6km from the onshore project area and is therefore located outside the designated sites study area used for this EclA. The conclusions of the HRA Report with respect to The Broads SAC are summarised within Section 22.7.

Table 22.10 Designated sites for nature conservation of relevance to onshore ecology

Site Name	Level of Designation	Location (National Grid Reference (NGR) / Distance from onshore project area / size	Qualifying features/reasons for notification
Norfolk Valley Fens (Component: Booton Common)	SAC	TL 937960 0.6km 616.48ha	<p>Annex I habitats that are a primary reason for selection of this site:</p> <ul style="list-style-type: none"> Alkaline fens. <p>Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:</p> <ul style="list-style-type: none"> Northern Atlantic wet heaths with <i>Erica tetralix</i>; European dry heaths; Semi-natural dry grasslands and scrubland facies on calcareous substrates (<i>Festuco-Brometalia</i>) (* important orchid sites); Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>); Calcareous fens with <i>Cladium mariscus</i> and species of the <i>Caricion davallianae</i> (Priority feature); and Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (<i>Alno-Padion</i>, <i>Alnion incanae</i>, <i>Salicion albae</i>) (priority feature). <p>Annex II species that are a primary reason for selection of this site:</p> <ul style="list-style-type: none"> Narrow-mouthed whorl snail <i>Vertigo angustior</i>; and Desmoulin`s whorl snail <i>Vertigo moulinsiana</i>.
River Wensum	SAC, SSSI	TF 942246 to TG 250078 Within onshore project area 306.79ha	<p>SAC</p> <p>Annex I habitats that are a primary reason for selection of this site:</p> <ul style="list-style-type: none"> Watercourses of plain to montane levels with the <i>Ranunculion fluitantis</i> and <i>Callitriche-Batrachion</i> vegetation. <p>Annex II species that are a primary reason for selection of this site:</p> <ul style="list-style-type: none"> White-clawed (or Atlantic stream) crayfish. <p>Annex II species present as a qualifying feature, but not a primary reason for selection of this site:</p> <ul style="list-style-type: none"> Desmoulin`s whorl snail <i>Vertigo moulinsiana</i>; Brook lamprey <i>Lampetra planeri</i>; and Bullhead <i>Cottus gobio</i>.

Site Name	Level of Designation	Location (National Grid Reference (NGR) / Distance from onshore project area / size	Qualifying features/reasons for notification
			<p>SSSI</p> <p>The Wensum has been selected as one of a national series of rivers of special interest as an example of an enriched, calcareous lowland river. With a total of over 100 species of plants, a rich invertebrate fauna and a relatively natural corridor, it is probably the best whole river of its type in nature conservation terms, although short stretches of other similar rivers may show a slightly greater diversity of species.</p> <p>Key features: calcareous river habitat, flora, invertebrate assemblage.</p>
Paston Great Barn	SAC, SSSI	<p>TG 322344</p> <p>3km (NB: located outside of 2km buffer, but scoped in due to large home range of interest feature (barbastelle bat))</p> <p>0.95ha</p>	<p>SAC</p> <p>Annex II species that are a primary reason for selection of this site</p> <ul style="list-style-type: none"> • Barbastelle bat. <p>SSSI</p> <p>This site is notified as it supports the only barbastelle bat maternity roost in Norfolk and one of only three known in the UK.</p> <p>Key features: barbastelle bat.</p>
Beetley & Hoe Meadows	SSSI	<p>TF 982174 to TF 979169</p> <p>1.4km</p> <p>11.7ha</p>	<p>Beetley and Hoe Meadows are situated in the valley of a tributary of the River Wensum, and represent one of the finest remaining areas of wet unimproved grassland in Norfolk. Springs emerge from the valley-side and variations in the acidity and dampness of the underlying soils account for the exceptionally wide range of grassland communities occurring on the site. The unimproved grassland is species-rich and includes several locally uncommon plants. The meadows are under a traditional management of summer grazing.</p> <p>Key features: wet unimproved grassland habitat, locally uncommon flora.</p>
Dereham Rush Meadow	SSSI	<p>TF 976140</p> <p>0.4km</p> <p>20.6ha</p>	<p>This site comprises an area of winter-flooded meadowland and alder carr along the valley of a small tributary of the River Wensum, and exhibits a wide range of grassland and woodland communities which are particularly unusual in Norfolk. The site is also of interest for its breeding bird population including snipe, lapwing, sedge warbler and reed warbler, and winter floods are periodically used by waterfowl.</p> <p>Key features: grassland and woodland habitats, breeding bird assemblage.</p>
Foxley Wood	SSSI, NNR	TG 056227	SSSI

Site Name	Level of Designation	Location (National Grid Reference (NGR) / Distance from onshore project area / size	Qualifying features/reasons for notification
		1.5km 122.7ha	<p>Foxley Wood forms the largest area of ancient woodland now remaining in Norfolk, and includes an unusually wide range of woodland stand types, including several which are nationally rare. The wood is also exceptionally rich in plant species, with over 250 different species recorded, and there is in addition considerable entomological interest, in particularly butterfly species.</p> <p>NNR Foxley Wood NNR is the NWT's premier woodland reserve and the largest remaining ancient woodland in the county. The site is a good example of how ancient woodland can be restored following coniferisation.</p> <p>Key features: ancient woodland, nationally rare woodland stands types, flora assemblage, and rare butterflies.</p>
Dillington Carr, Gressenhall	SSSI	TF 971158 0.4km 49.0ha	<p>This site is an extensive area of carr woodland and open water occupying the valley floor and sides of a small tributary of the River Wensum. The wettest areas of carr are probably the best example of sump alder woodland in west Norfolk, closely resembling the carr woodlands found in Broadland. The site also includes extensive stands of the nationally rare lowland bird cherry-alder woodland. Irrigation reservoirs have been created within the carr and these flooded areas of former woodland support the freshwater component of an outstanding assemblage of breeding birds including several uncommon species.</p> <p>Key features: sump alder woodland habitat, lowland bird cherry-alder woodland habitat, breeding bird assemblage.</p>
East Ruston Common	SSSI	TG 340280 2km 38.3ha	<p>East Ruston Common is a large area of unimproved heathland and fen situated in the valley of a tributary of the River Ant. Acidic flushes emerging from sands and gravels at the base of surrounding high ground, are a notable feature of the site and an unusual plant community has developed in these conditions, providing a contrast with the majority of the spring-fed fens which are calcareous. There is a very clear zonation of vegetation types from acidic grassland through acidic flush and fen to carr woodland on the lowest-lying ground. Two rare species of spider have been recorded on the site.</p> <p>Key features: unusual acidic fen habitat, rare spider species.</p>
Holly Farm Meadow, Wendling	SSSI	TF 936131 0.9km 2.5ha	<p>This site, which is situated in the valley of a small tributary of the River Wensum, is a valuable example of a calcareous spring-line meadow with gradations between wet and dry conditions. It supports an area of species-rich unimproved fen grassland which is maintained by seasonal grazing.</p> <p>Key features: calcareous spring-line meadow habitat.</p>

Site Name	Level of Designation	Location (National Grid Reference (NGR) / Distance from onshore project area / size	Qualifying features/reasons for notification
Honeypot Wood, Wendling	SSSI	TF 932144 1.4km 9.03ha	A good example of an ancient, coppiced, ash-maple wood on calcareous soil. Key features: ancient woodland habitat.
Whitwell Common	SSSI	TG 088206 1.2km 19.17ha	Whitwell Common lies in the valley of a tributary of the River Wensum and supports a wide range of wetland plant communities' characteristic of peat-based soils. Calcareous flushes are present in low-lying hollows created by past peat cutting and a variety of interesting plants are associated with this uncommon habitat type. Wet valley alder wood, fen communities and unimproved neutral grassland are also represented on the site. Key features: unimproved grassland habitat, alder carr habitat, flora assemblage.
Bryant's Heath, Felmingham	SSSI	TG 259294 1.5km 17.56ha	Bryant's Heath is an area of dry acidic heathland, unusual in that it encompasses within a relatively small area a mix of dry heath, wet heath and fen communities. Rich plant communities, including several plants that are now uncommon in East Anglia are present. Key features: dry heathland habitat, wet heathland habitat, nationally uncommon flora
Cawston and Marsham Heaths	SSSI	TG 170235 1.8km 125.7ha	Cawston and Marsham Heaths form the largest area of Heather-dominated heathland now remaining in east Norfolk. They represent a locally scarce type which shows affinities to the Atlantic coastal heaths found in western Britain. There is a diverse flora which includes a rich assemblage of lichens. The site is also of considerable ornithological interest. Key features: dry heathland habitat, breeding bird assemblage, wintering bird roost (hen harriers).
Happisburgh Cliffs	Geological SSSI, no ecological reasons for notification		
Booton Common	SSSI	TG 113230 0.6km 7.73ha	Booton Common lies in the valley of a tributary of the River Wensum, about 1 mile east of Reepham. The principal interest of the site is associated with a mosaic of wet calcareous fen grassland and acid heath communities which have developed due to the naturally undulating ground. Areas of tall fen and a strip of valley alder woodland occupy the lower ground adjacent to the stream. Key features: wet heathland habitat, calcareous fen habitat, breeding bird assemblage.
Felmingham Cutting	LNR	TG 248 287	A butterfly nature reserve, home to 16 different species.

Site Name	Level of Designation	Location (National Grid Reference (NGR) / Distance from onshore project area / size	Qualifying features/reasons for notification
		2km 1.04ha	
Knapton Cutting	LNR	TG 299 329 1.1km 0.87ha	A butterfly nature reserve.
Pigney's Wood	LNR	TG295319 Adjacent to onshore project area 20.87ha	Pigney's Wood is a woodland site with reedbeds, a scrape, and wildflowers, butterflies, trees and birds.
Cawston Wood ⁵	Ancient Woodland	N/A ⁴	Identified in the Ancient Woodland Inventory.
Foxley Wood			
Great Wood ⁵			
Honeypot Wood			
Jack Bells Grove			
Necton Wood ⁵			
Newhall Grove			
North Grove ⁵			
Old Carr			
Old Lane Carr			
Potters Grove			

⁴ Data not available

⁵ Also a County Wildlife Site

Site Name	Level of Designation	Location (National Grid Reference (NGR) / Distance from onshore project area / size	Qualifying features/reasons for notification
Sparham Grove	Ancient Woodland	N/A ⁴	Identified in the Ancient Woodland Inventory.
Sparham Wood ⁶			
The Leaselands			
The Tollands ⁶			
5 x Unnamed Woodlands ⁶			

⁶ Also a County Wildlife Site, only 4 of the unnamed woodlands

22.6.2 Non-statutory Designated Sites

98. There are 95 non-statutory designated sites (CWS) and Roadside Nature Reserves (RNR) within and up to 2km of the designated sites study area, as shown on Figure 22.3. Five of these sites are located directly within the onshore project area. These sites are Wendling Carr CWS (CWS no. 1013), Little Wood CWS (CWS no. 2024), Land South of Dillington Carr CWS (CWS no. 1025), Marriott's Way CWS (CWS no. 2176) (crossed twice) and Paston Way and Knapton Cutting CWS (CWS no. 1175). In addition, there is a proposed CWS which, if it receives designation, will be located within the onshore project area at Kerdiston between Kerdiston Hall and the Marriott's Way ('Kerdiston Old Hall Meadows').
99. 11 of these 95 CWS are also designated as ancient woodlands (Table 22.10) including Necton Wood, which is in close proximity to the onshore project substation.
100. All non-statutory designated sites are considered to be of medium importance.

22.6.3 Terrestrial Habitats

101. The baseline presented here is based on the findings from the 2017 and 2018 Extended Phase 1 Habitat Surveys. Where habitats were not recorded during these surveys due to landowner access restrictions, they have been described using the information gathered from the Norfolk 'Living Map'. Full details of the habitats present are provided in Appendix 22.1 Extended Phase 1 Habitat Survey Reports. Features of interest are denoted using Target Notes (TNs), which are referenced using a numbering system. The locations of the TNs are shown on Figure 22.5, and further details are provided within Appendix 22.1. Please note that habitat areas provided here relate to the areas of habitat found within the onshore project area, not the species study area (i.e. the onshore project area plus a 50m buffer).

22.6.3.1 Woodland

102. Several woodland habitats are UKHPI, including the following three habitat types, which are present within the species study area:
 - Lowland mixed woodland;
 - Wet woodland; and
 - Wood-pasture and parkland.
103. Lowland mixed deciduous woodland, wet woodland, and wood-pasture and parkland are also listed as Priority Habitats on the Norfolk LBAP.
104. There are approximately 8.3ha of woodland habitat located within the onshore project area (see Figure 22.5), equating to approximately 1.9% of the onshore project area. The majority of this woodland habitat comprises broadleaved and

coniferous plantation woodland (4.1ha), and broadleaved semi-natural woodland (4.2ha).

105. Small parcels of lowland mixed woodland are located within the onshore project area at TN7 on the east side of the River Bure, TN10 at the King's Beck, TN78, at the railway cutting at Northall Green (TN173), at two locations on The Marriott's Way (TN264), and at Witton Hall (see Figure 22.5). Land at Dillington Carr (TN158) is also an area of transitional wet woodland habitat.
106. Typical semi-natural woodland composition recorded during the 2017 and 2018 Extended Phase 1 Habitat Surveys was English oak *Quercus robur* and ash *Fraxinus excelsior* woodland, with alder *Alnus glutinosa* and goat willow *Salix caprea* with an understorey dominated by hazel *Corylus avellana*, hawthorn *Crataegus monogyna* and elder *Sambucus nigra*. Ground flora typically comprised of dog's mercury *Mercurialis perennis*, nettle *Urtica dioica*, lords and ladies *Arum maculatum*, wood avens *Geum urbanum* and ground ivy *Glechoma hederacea*.
107. Mixed semi-natural woodland is also present within the species study area and typically consists of: beech *Fagus sylvatica*, ash, English oak, sweet chestnut *Castanea sativa*, larch *Larix decidua* and cherry laurel *Prunus laurocerasus*.
108. Small areas within the 2017 and 2018 survey area were classified as wood-pasture and parkland, typically where oak standards in hedgelines had become overgrown and remained after the hedgeline had been removed.

22.6.3.2 Scrub

109. Approximately 0.8ha of scrub habitat is located in scattered parcels throughout the onshore project area (see Figure 22.5). The areas where scrub was recorded represented a range of habitat sub-types, including transitional habitat between woodland and grassland, boundary features, waste ground, watercourse margins or field margins. Species composition varied, with elder and crack willow *Salix fragilis* common in wood scrub and bramble dominating where no woody species were present.

22.6.3.3 Isolated trees

110. Isolated trees are located throughout the species study area, associated with previous hedgerow lines, other linear features (e.g. fence lines and watercourses), isolated within the middle of pasture fields or private residential gardens.
111. Two veteran trees (one English oak, one alder) were noted during the 2017 and 2018 Extended Phase 1 Habitat Surveys at TN168 and TN288 (see Figure 22.5).

22.6.3.4 Hedgerows

112. Hedgerows are both UKHPI and Norfolk LBAP priority habitats.

113. A total of 355 hedgerows were recorded within the species study area during the 2017 and 2018 Extended Phase 1 Habitat Survey, of which 143 are located within the onshore project area. A further 53 were identified from the Norfolk 'Living Map', totalling approximately 2.5km in length of hedgerow. These hedgerows are located both along the margins and throughout the onshore project area (see Figure 22.5).
114. Of the 143 hedgerows recorded within the onshore project area during the 2017 and 2018 Extended Phase 1 Habitat Survey, 88 hedgerows are species-rich (both intact and defunct, and with/without trees). The remaining 55 hedgerows are species-poor (both intact and defunct, and with/without trees), all of which are common features throughout the onshore project area.
115. Species-rich hedgerows typically consisted of shrub and tree species including field maple, elm, hawthorn, blackthorn *Prunus spinosa*, rose *Rosa canina*, hazel, English oak, holly *Ilex spp.*, ash, ivy *Hedera spp.*, with ground flora typically including common nettle, cleavers *Galium aparine*, broad-leaved dock *Rumex obtusifolius*, herb Robert *Geranium robertianum*, dog's mercury, lords and ladies, and red dead-nettle *Lamium purpureum*. Species-poor hedgerows were characterised as having fewer than five species in a 30m stretch and were typically dominated by hawthorn.

22.6.3.5 Unimproved and semi-improved grassland

116. No areas of unimproved grassland were recorded within the species study area.
117. Semi-improved grassland was recorded within the onshore project area during the 2017 and 2018 Extended Phase 1 Habitat Surveys, covering approximately 3.3ha (0.8% of the onshore project area).
118. The areas of semi-improved grassland recorded during the 2017 and 2018 Extended Phase 1 Habitat Surveys comprise coarse, ruderal grass species and ruderal herbs. Cock's foot *Dactylis glomerata*, rough meadow grass *Poa trivialis*, meadow foxtail *Alopecurus pratensis*, ribwort plantain *Plantago lanceolata*, creeping buttercup *ranunculus repens*, white clover *Trifolium repens* and red dead-nettle *Lamium purpureum* are common species found within these habitats.
119. No species-rich grasslands were noted during the 2017 and 2018 Extended Phase 1 Habitat Surveys.

22.6.3.6 Marshy grassland

120. Marshy grassland was recorded in nine locations within the onshore project area during the 2017 and 2018 Extended Phase 1 Habitat Survey, totalling approximately 12.8ha (2.9% of the onshore project area).
121. Marshy grassland was recorded adjacent to watercourses within the species study area, at the River Wensum, River Bure, North Walsham and Dilham Canal and at

minor watercourses near Salle and Sparham during the 2017 and 2018 Extended Phase 1 Habitat Surveys. Patches of common rush *Juncus effuses* in the wet areas are typical, with pendulous sedge *Carex pendula*, common vetch *Agrostis capillaris*, common bent and cranesbill *Geranium pratense*.

122. Selected areas of marshy grassland are also classified as coastal and floodplain grazing marsh, which is both a UKHPI and Norfolk LBAP priority habitat. This habitat is located in three areas within the species study area: namely at the River Wensum, Salle, and the North Walsham and Dilham Canal (see Figure 22.4).

22.6.3.7 Improved grassland

123. Improved grassland which is subject to regular grazing was recorded in 11 separate locations within the onshore project area during the 2017 and 2018 Extended Phase 1 Habitat Surveys, and a further seven areas were identified from the Norfolk 'Living Map' (see Figure 22.5) totalling approximately 2.1% of the onshore project area. Typically, where this habitat has been recorded, the sward was short and grazed, and of low diversity, dominated by cock's foot and perennial rye-grass *Lolium perenne* with broad-leaved dock *Rumex obtusifolius*, sorrel *Rumex acetosa*, and patches of nettle, ragwort *Senecio jacobaea* and thistle species *Cirsium sp.*

22.6.3.8 Tall ruderal vegetation

124. Localised areas of tall ruderal habitat were recorded within the species study area during the 2017 and 2018 Extended Phase 1 Habitat Surveys (see Figure 22.5). This habitat was recorded typically along roads or track boundaries, or adjacent to scrub land. The typical species recorded include common nettle, common hogweed *Heracleum sphondylium*, broad-leaved dock and ribwort plantain.

22.6.3.9 Lowland fen

125. Lowland fen, which is a UKHPI, was also noted within the species study area at Dillington Carr in the data received as part of the desk study (JNCC, 2016). Survey access to this location has not been possible at the time of preparing this ES, and the Norfolk Living Map identifies this habitat as deciduous woodland, so it is uncertain as to the actual nature of this habitat. Prior to ground-truthing post-consent, and based on JNCC data and aerial photography of the site, it is assumed that this habitat is indeed lowland fen. Desk study data received from JNCC indicates that there is 1.0ha of lowland fen within the species study area, all of which is located at Dillington Carr.
126. Lowland fen is also a Norfolk LBAP priority habitat.

22.6.3.10 Standing water

127. Ponds are a UKHPI and Norfolk LBAP priority habitat.
128. There are a total of 220 standing water bodies (i.e. ponds, lakes, ditches) located within the great crested newt study area⁷, of which 19 are located within or adjacent to the onshore project area (see Figure 22.5). Standing water accounts for approximately 0.7ha (0.2%) of habitat within the onshore project area.

22.6.3.11 Running water

129. Rivers are a UKHPI but are not a Norfolk LBAP priority habitat.
130. There are five main rivers located within the species study area (see Chapter 20 Water Resources and Flood Risk for locations). These are:
- River Wensum;
 - River Bure;
 - King's Beck;
 - Wendling Beck; and
 - North Walsham and Dilham Canal.
131. In addition, there are numerous minor watercourses and field drains located throughout the species study area.

22.6.3.12 Coastal habitats

132. There are two coastal habitat types within the species study area. These include intertidal sand and dune grassland, which cover 6.3ha (1.4%) and 0.8ha (0.2%) of the onshore project area respectively. Coastal sand dunes are a UKHPI and Norfolk LBAP priority habitat.

22.6.3.13 Other habitats

22.6.3.13.1 Arable land

133. The largest habitat by area within the species study area is arable land (382ha). This equates to approximately 87% of the onshore project area.
134. Whilst arable land is not a designated habitat, cereal field margins are a UKHPI and Norfolk LBAP priority habitat. These will constitute a small proportion of the 382ha identified above.

22.6.3.13.2 Buildings

135. There are no significant built-up areas within the species study area; however, there are several buildings and structures which were noted during the 2017 and 2018

⁷ Within 250m of the temporary onshore project area and within 500m of the permanent onshore project area (Figure 22.5)

Extended Phase 1 Habitat Surveys. These are primarily residential dwellings and farm buildings.

22.6.3.14 Summary

136. Table 22.11 summarises the footprints of each habitat type described in section 22.6.3. The totals below are the combined totals derived from the 2017 and 2018 Extended Phase 1 Habitat Surveys and the Norfolk Living Map, unless otherwise specified.

Table 22.11 Habitat footprints within the onshore project area

Habitat type	Area (ha)	% of onshore project area	Habitat designation
Lowland mixed deciduous woodland	0.6	0.1%	UKHPI, Norfolk LBAP
Broadleaved semi-natural woodland	3.6	0.8%	UKHPI, Norfolk LBAP
Broadleaved plantation woodland	0.6	0.1%	UKHPI, Norfolk LBAP
Coniferous plantation woodland	3.0	0.7%	-
Mixed plantation woodland	0.5	0.1%	-
Dense/continuous scrub	0.7	0.2%	-
Scattered scrub	0.1	<0.1%	-
Broadleaved parkland / scattered trees	<0.1	<0.1%	UKHPI, Norfolk LBAP
Improved grassland	9.1	2.1%	-
Marshy grassland	12.8	2.9%	-
Coastal and floodplain grazing marsh	0.1	<0.1%	UKHPI, Norfolk LBAP
Semi-improved grassland	3.3	0.8%	-
Poor semi-improved grassland	6.4	1.4%	-
Tall ruderal	0.1	<0.1%	-
Standing water	0.7	0.2%	UKHPI, Norfolk LBAP
Running water	0.7	0.2%	UKHPI
Cultivated / disturbed land - arable	382.1	86.7%	(NB: cereal field margins are a UKHPI and Norfolk LBAP habitat)
Cultivated / disturbed land - amenity grassland	0.7	0.2%	-
Gardens	0.5	0.1%	-
Bare ground	1.3	0.3%	-
Urban	6.5	1.5%	-

Habitat type	Area (ha)	% of onshore project area	Habitat designation
Other habitat	0.1	<0.1%	-
Intertidal mud / sand	6.3	1.4%	UKHPI
Dune grassland	0.8	0.2%	Norfolk LBAP
Beach	<0.1	<0.1%	-
Maritime Cliff and Slopes	<0.1	<0.1%	UKHPI, Norfolk LBAP

22.6.4 Ecological Networks

137. The onshore project area is not located within any of The Wildlife Trusts' 'Living Landscapes' areas.
138. The onshore project area crosses three key ecological networks identified by the 2006 *Report of Ecological Network Mapping Project for Norfolk* (NWT, 2006), namely the River Wensum and River Bure river valleys and the North Walsham and Dilham Canal.

22.6.5 Protected, Notable and Invasive Species

139. This section provides a summary of the key species recorded within the habitats and species study area, drawing on the information provided by NBIS, the Environment Agency and the NBSG, findings of the 2017 and 2018 field surveys conducted to date (see Table 22.9 for further information).

22.6.5.1 Badgers

22.6.5.1.1 Desk study

140. [REDACTED]

22.6.5.1.2 Field survey

141. [REDACTED] Numerous field signs including latrines, tracks, paths and snuffle holes were observed within the survey

area. [REDACTED]

- 142. Approximately 35% of the survey area has not been surveyed for badgers as landowner access could not be agreed, as set out in section 22.5.3. The impacts described in section 22.7 consider the potential impacts on the badger resource found, and on the potential resource present within the unsurveyed areas.
- 143. Badgers are protected under the Protection of Badgers Act 1992.
- 144. As a regularly occurring population of a nationally important species which is not threatened or rare in the county, badgers are considered to be of low importance.

22.6.5.2 Bats

22.6.5.2.1 Desk study

- 145. NBIS hold records of eight species of bat within 5km of the onshore project area, namely:
 - Western Barbastelle *Barbastella barbastellus*;
 - Serotine *Eptesicus serotinus*;
 - Natterer's *Myotis nattereri*;
 - Lesser noctule *Nyctalus leisleri*;
 - Nathusius's pipistrelle *Pipistrellus nathusii*;
 - Common pipistrelle *Pipistrellus pipistrellus*;
 - Soprano pipistrelle *Pipistrellus pygmaeus*; and
 - Brown long-eared *Plecotus auritus*.
- 146. These species have been recorded at various locations, including Witton Bridge, Ridlington, Edingthorpe, Brick Kiln Farm, Bacton, Blickling, Silvergate Village, Edingthorpe and Edingthorpe Green.
- 147. In addition, NBSG hold records of a further one species, Daubenton's bat, within 5km of the onshore project area.
- 148. NBSG also hold records of a further 29 bat roosts located within 5km of the onshore project area. These results are summarised in Table 22.12.

Table 22.12 NBSG bat roost records

Roost location	Roost type	Species present
Blickling Hall Estate, Great & Waterloo Woods (7 roosts)	Maternity	Barbastelle

⁸ Please note – due to ongoing persecution of this species the results of the badger survey are confidential and the relevant sections of Appendix 22.1 will not be publicly available.

Roost location	Roost type	Species present
Blickling	Hibernation	Daubenton's Natterer's Brown long-eared Barbastelle
Hercules Wood	Hibernation	Daubenton's Natterer's Brown long-eared Barbastelle
Bacton Wood	Bat box	Common pipistrelle Soprano pipistrelle Natterer's
Witton Hall	Hibernation	Daubenton's Natterer's Brown long-eared
Witton Church	Maternity	Brown long-eared
Ridlington Church	Maternity	Common pipistrelle
Paston Great Barn	Maternity Day Hibernation	Common pipistrelle (day; hibernation) Soprano pipistrelle (day; hibernation) Natterer's (maternity) Brown long-eared (maternity) Barbastelle (maternity)
Old Hill Woods	Maternity	Barbastelle
Calthorpe Broad	Maternity	Barbastelle
Swan Farm, Meeting House Hill	Bad weather	Barbastelle
White Horse Common	Bad weather	Barbastelle
Edingthorpe Heath	Day	Barbastelle
Edingthorpe Green	Day	Barbastelle
Witton Hall (4 roosts)	Day Bad weather	Barbastelle
Manor Farm, Witton Bridge	Day	Barbastelle
The Grange, Pollard Street	Day	Barbastelle
Stow Hill	Bad weather	Barbastelle
Paston Green	Day	Barbastelle
Knapton House	Day	Barbastelle

149. None of these bat roosts are located within the habitat and species study area.

150. Approximately 4km of the onshore cable route is within the known home ranges of the Old Hills and Paston Great Barn barbastelle colonies, as indicated by the data obtained from the NBSG and from their radio-tracking surveys. Table 22.13 contains details of the core foraging areas for the Paston Great Barn and Old Hills colonies found within the onshore project area.

Table 22.13 Core foraging areas of the Paston Great Barn and Old Hills barbastelle colonies

Core foraging area	Barbastelle maternity colony	Activity type
North Walsham and Dilham Canal and land east of the North Walsham and Dilham Canal	Paston Great Barn Old Hills	Foraging
Hedgerow along North Walsham Road from Edingthorpe Green to Edingthorpe Heath	Paston Great Barn Old Hills	Commuting / foraging
Witton Hall Plantation along Old Hall Road	Paston Great Barn	Commuting / foraging
Road from Bacton Wood to Witton	Paston Great Barn	Commuting
Two hedgerows between Witton and North Walsham Road	Paston Great Barn	Commuting / foraging

151. In addition to the core foraging area described above, occasional foraging bats have also been recorded along the drains and hedgerows at Ridlington Street.

22.6.5.2.2 Field survey

Bat roosts

152. All trees and structures (a total of 405 features) noted during the 2017 and 2018 Extended Phase 1 Habitat Survey were assessed from the ground using binoculars (following the Bat Conservation Trust's (BCT) Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Ed.) (2016)) for their suitability to support roosting bats. Following route refinement since the 2017 Extended Phase 1 Habitat Survey, 134 of these are now located within the habitat and species study area of which 45 are located within the onshore project area (see Figure 22.5).
153. Of the 134 trees and structures located within the habitat and species study area, 80 were assessed as providing low suitability for roosting bats and 46 as providing moderate suitability. Full details of the preliminary daytime roost assessments are provided in Appendix 22.1.
154. Those trees with low suitability for supporting roosting bats were not surveyed (following the BCT's Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition) (BCT, 2016), no surveys are required). 19 of the 46 trees identified as

providing moderate suitability were subject to bat emergence / re-entry surveys during 2017 to confirm the presence/absence of roosting bats. Of the remaining 27 trees, seven were subject to bat emergence / re-entry surveys (as three 'groups') during 2018. These surveys were undertaken in accordance with the methodology outlined in the 2016 BCT guidance, i.e. each tree / structure, was subject to two survey visits (i.e. one dusk emergence survey and one dawn re-entry survey) between May and September with one survey visit between May and August. Full details of the 2017 and 2018 bat emergence / re-entry surveys are provided within Appendix 22.5.

155. The bat emergence / re-entry surveys recorded no roosts present within these 35 trees within the onshore project area. However, three bat roosts were confirmed within the trees and structures located within the habitat and species study area. These roosts include a probable pipistrelle spp. roost (NV-BER20), a soprano pipistrelle roost (NV-BER22) and a brown-long eared roost (NV-BER44).
156. 20 of the 35 trees within the habitat and species study area identified as providing moderate suitability and scoped into the 2017 and 2018 bat emergence / re-entry surveys were not surveyed due to landowner access constraints (nine in 2017; eleven in 2018).
157. A review of the Living Map dataset has identified 11 additional locations as potentially providing roosting habitat for bats, due to the presence of trees or structures, which were unable to be surveyed during the 2017 or 2018 Extended Phase 1 Habitat Survey, as set out in section 22.5.3. The impacts described in section 22.7 consider the impacts on the bat resource within the three known roosts located within the habitat and species study area plus the potential impacts of the 20 unsurveyed trees and the potential bat resource present within the unsurveyed areas.

Commuting and foraging bats

158. In addition to trees and structures, all linear features (e.g. watercourses, hedgerows) were categorised in terms of their suitability to support commuting or foraging bats following the BCT 2016 guidance (BCT, 2016). This categorisation was based on the habitat type and their connection to the surrounding habitat. The categorisation used was:

- Defunct hedgerows and field drains typically provided low suitability for commuting and foraging bats;
- Intact species rich hedgerows, areas of scrub and small watercourses typically provided moderate suitability for commuting and foraging bats; and

- Species-rich hedgerows with trees and large watercourses well connected to the wider landscape typically provided high suitability for commuting and foraging bats.
159. In total, 335 linear features (which included both watercourses and hedgerows) were assessed for their suitability to support commuting or foraging bats during the 2017 and 2018 Extended Phase 1 Habitat Surveys. Of these, 117 were assessed as providing low suitability to support commuting or foraging bats, 218 as providing moderate or high suitability.
160. Following onshore route refinements since the 2017 Extended Phase 1 Habitat Survey, only 143 of the 335 linear features are located within the onshore project area. Of these, 55 are assessed as providing low suitability to support commuting or foraging bats and 88 as providing moderate or high suitability. The locations of these commuting and foraging features are shown on Figure 22.5. A further 53 potential linear features have been identified within the onshore project area using the Living Map.
161. Bat activity surveys were undertaken to ascertain the level of bat activity along the commuting or foraging features identified as providing moderate or high suitability to supporting commuting or foraging bats. Those features with low suitability for supporting commuting or foraging bats were not surveyed (following the BCT's Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd edition) (BCT, 2016)). The linear features identified as providing moderate or high suitability to supporting commuting or foraging bats during the 2017 Extended Phase 1 Habitat Survey were grouped into a series of habitat networks, following which 24 survey transects were designed to cover as many of the habitat networks as possible. Subsequently, a suite of bat activity surveys (herein 'the 2017 bat activity surveys') were undertaken along the 24 transects within the onshore project area between May and October 2017. A further seven transects were designed based on the findings of the 2018 Extended Phase 1 Habitat Survey. These seven additional transects were surveyed between April and October 2017 (herein 'the 2018 bat activity surveys'). The location of these transects and the locations of the commuting and foraging features are shown on Figure 22.8.
162. Data were collected over a six-month period with the aim of providing a detailed understanding of the usage of potential commuting and foraging features within the onshore project area by bats. Where survey access was possible, all transects were walked bi-monthly and all bat echolocations recorded. Static detectors were also set out along each transect for five nights each month, with two or three detectors placed on transects covering linear features identified as providing 'moderate' or 'high' suitability for supporting commuting and foraging bats respectively. Data collected from 24 transects was identified as suitably robust to draw conclusions

about the value of the linear features for commuting / foraging bats. Full details of the 2017 and 2018 bat activity surveys and the process of scoping the surveys are provided within Appendix 22.4.

163. Bats were recorded on all transects surveyed and often in large numbers, with peak counts for bat passes reaching over 1,000 passes on eight transects. A total of nine species were recorded during the entire suite of the 2017 bat activity surveys. The nationally rare barbastelle species was recorded at 28 out of 31 transects surveyed. The species recorded are summarised in Table 22.14.

Table 22.14 Species recorded during 2017 and 2018 bat activity surveys

Species	No. of transects recorded	Transects recorded	UK Status ⁹	Habitat preferences
Barbastelle	28	BACT04, BACT05, BACT08, BACT09, BACT10, BACT13, BACT14, BACT16, BACT17, BACT18, BACT19, BACT20, BACT21, BACT22, BACT26, BACT28, BACT30, BACT31, BACT32, BACT33, BACT34 NB-BACT01, NB-BACT02, NB-BACT03, NB-BACT04, NB-BACT05, NB-BACT06, NB-BACT07	Rare	Riparian zones and broad-leaved woodland were habitats most strongly selected for foraging. Hedgerows should be protected as commuting corridors (Zeale et al., 2012).
Serotine	26	BACT04, BACT05, BACT08, BACT10, BACT14, BACT16, BACT17, BACT18, BACT19, BACT20, BACT21, BACT22, BACT26, BACT28, BACT29, BACT30, BACT31, BACT32, BACT34 NB-BACT01, NB-BACT02, NB-BACT03, NB-BACT04, NB-BACT05, NB-BACT06, NB-BACT07	Uncommon, largely restricted to south of U.K.	Less dependent on hedgerows than smaller species (Verboom & Huitema 1997).
Leisler's	7	BACT05, BACT08, BACT09, BACT17, BACT27, BACT29, BACT30,	Uncommon in GB although may be under recorded [Few records in Norfolk]	[Data not available – however likely similar to noctule species.]
Myotis spp. (inc. Daubenton's)	30	BACT04, BACT05, BACT08, BACT09, BACT10, BACT13, BACT14, BACT16, BACT17,	Common	Closely associated with hedgerows for commuting / foraging (Limpens & Kapteyn 1991)

⁹ Source: Bat Conservation Trust (2014) The state of the UK's bats 2014 National Bat Monitoring Programme Population Trends <http://www.bats.org.uk/pages/nbmp.html>

Species	No. of transects recorded	Transects recorded	UK Status ⁹	Habitat preferences
		BACT18, BACT19, BACT20, BACT21, BACT22, BACT26, BACT27, BACT28, BACT29, BACT30, BACT31, BACT32, BACT33, BACT34 NB-BACT01, NB-BACT02, NB-BACT03, NB-BACT04, NB-BACT05, NB-BACT06, NB-BACT07		
Noctule	30	BACT03, BACT04, BACT05, BACT08, BACT09, BACT10, BACT13, BACT14, BACT16, BACT17, BACT18, BACT19, BACT20, BACT21, BACT22, BACT26, BACT28, BACT29, BACT30, BACT31, BACT32, BACT33, BACT34 NB-BACT01, NB-BACT02, NB-BACT03, NB-BACT04, NB-BACT05, NB-BACT06, NB-BACT07	Uncommon	Tree roosting species, less dependent on hedgerows than smaller species (Verboom & Huitema 1997).
Nathusius' pipistrelle	29	BACT03, BACT04, BACT05, BACT09, BACT10, BACT14, BACT16, BACT17, BACT18, BACT19, BACT20, BACT21, BACT22, BACT26, BACT27, BACT28, BACT29, BACT30, BACT31, BACT32, BACT33, BACT34 NB-BACT01, NB-BACT02, NB-BACT03, NB-BACT04, NB-BACT05, NB-BACT06, NB-BACT07	Uncommon but widespread, may be under recorded [Few records in Norfolk]	Less dependent on hedgerows than other species (Kelm et al, 2014)
Common pipistrelle	31	BACT03, BACT04, BACT05, BACT08, BACT09, BACT10, BACT13, BACT14, BACT16, BACT17, BACT18, BACT19, BACT20, BACT21, BACT22, BACT26, BACT27, BACT28, BACT29, BACT30, BACT31, BACT32, BACT33, BACT34 NB-BACT01, NB-BACT02, NB-BACT03, NB-BACT04, NB-BACT05, NB-BACT06, NB-BACT07	Common	Closely associated with hedgerows for commuting / foraging (Limpens & Kapteyn 1991; Kelm et al, 2014))
Soprano pipistrelle	31	BACT03, BACT04, BACT05, BACT08, BACT09, BACT10, BACT13, BACT14, BACT16,	Common	Closely associated with hedgerows for commuting /

Species	No. of transects recorded	Transects recorded	UK Status ⁹	Habitat preferences
		BACT17, BACT18, BACT19, BACT20, BACT21, BACT22, BACT26, BACT27, BACT28, BACT29, BACT30, BACT31, BACT32, BACT33, BACT34 NB-BACT01, NB-BACT02, NB-BACT03, NB-BACT04, NB-BACT05, NB-BACT06, NB-BACT07		foraging. (Kelm et al, 2014) Preference for presence of standard trees in linear features (Boughley et al., 2011)
Brown long-eared	26	BACT03, BACT04, BACT05, BACT16, BACT17, BACT18, BACT19, BACT20, BACT21, BACT22, BACT26, BACT27, BACT28, BACT29, BACT30, BACT31, BACT32, BACT33, BACT34 NB-BACT01, NB-BACT02, NB-BACT03, NB-BACT04, NB-BACT05, NB-BACT06, NB-BACT07	Common	Closely associated with hedgerows for commuting / foraging (Limpens & Kapteyn 1991; Kelm et al, 2014))

164. In order to determine the importance of the linear features which are located within the habitat and species study area, criteria have been defined and agreed with the Norfolk Vanguard ETG (which in turn also apply to Norfolk Boreas) in order to differentiate between important linear features which are integral to the functioning of the bat resource within the region. The following criteria have been used to identify an ‘important’ feature:

- At least one barbastelle passes on more than two separate survey nights (i.e. to ensure that it was not simply one bat flying round and round on one occasion); and
- A peak count of >200 bat passes along a single commuting / foraging feature within a transect¹⁰.

165. Barbastelle bats are rare across Europe and therefore any linear feature which is reliably used as a commuting or foraging feature is an important linear feature. Based on the evidence from the dataset collected, a >1% relative abundance

¹⁰ The Norfolk Vanguard assessment used the relative abundance of the peak count for each transect to identify suitable threshold for ‘importance’ for commuting / foraging features. All features of greater than 1% relative abundance were identified as being important. 1% relative abundance in the 2017 bat activity survey equated to a peak count of approximately 190 bat passes per night. Therefore a threshold of 200 bat passes per night has been used to identify importance, based on the results found in 2017.

threshold is considered a reasonable threshold for ensuring all key habitats for bats are included.

166. Table 22.15 summarises the results of applying these criteria to the datasets to identify important linear features.

Table 22.15 Important bat hedgerow networks (cells that are shaded in blue indicated that the transect meets the criteria for 'importance')

BACT	Bat passes - peak count per detector per night	No. of nights with 1+ barbastelle pass	Important bat hedgerow network	Species richness
2017				
3	177	0	-	5
4	527	2	Yes	8
5	1412	7	Yes	9
8	1197	1	Yes	7
9	301	3	Yes	7
10	845	10	Yes	7
13	723	0	Yes	5
14	684	11	Yes	7
16	999	3	Yes	6
17	664	3	Yes	9
18	716	4	Yes	9
19	594	7	Yes	8
20	894	5	Yes	8
21	176	2	-	6
22	550	13	Yes	7
26	494	1	Yes	9
27	1605	0	Yes	7
28	283	6	Yes	8
29	223	0	Yes	9
30	1329	3	Yes	9
31	877	6	Yes	8
32	697	8	Yes	8
33	1057	2	Yes	8
34	1542	5	Yes	8
2018				
1	350	7	Yes	8
2	518	2	Yes	8

BACT	Bat passes - peak count per detector per night	No. of nights with 1+ barbastelle pass	Important bat hedgerow network	Species richness
3	890	12	Yes	8
4	1162	3	Yes	8
5	338	6	Yes	8
6	775	6	Yes	8
7	1023	7	Yes	8

167. Twenty-nine of the 31 transects surveyed in 2017 and 2018 were identified as containing important features for commuting and foraging bats. Of the remaining two, BACT21 is located adjacent to North Walsham and Dilham Canal, which is within the known home range of the Paston Great Barn barbastelle maternity colony. The remaining survey transect, BACT03, is notable as it is the only transect which covers species-poor hedgerows (including those with trees).
168. Following refinement during the site selection process, BACT13, BACT34 and BACT30 are no longer located within the habitat and species study area and consequently have not been considered further in this EclA.
169. The results from the 2017 and 2018 surveys indicate that there is a very good bat resource present throughout the survey area, with species-rich intact hedgerows (with and without trees) providing a very well used network of habitats within the habitat and species study area. The results indicate that it is not possible to identify key areas and features within the habitats and species study area which are of higher value for commuting and foraging bats; rather that all suitable habitat should be assumed to be an important feature for commuting foraging bats. Therefore, for the purposes of this EclA, all species-rich hedgerows which occur within the habitat and species study area are assumed to be important bat commuting / foraging features, and are considered as such with sections 22.7 and 22.8. Where species-poor intact hedgerows have been identified, although not 'important', these have been demonstrated within the 2017 and 2018 activity surveys to still support a smaller bat assemblage and therefore also provide commuting and foraging habitat within the wider landscape.
170. A review of the Living Map dataset identified 53 linear features as potentially providing suitable habitat for commuting or foraging bats due to the presence of intact hedgerows, watercourses, scrub, and other linear features. No information is available concerning the suitability of these features to support commuting or foraging bats. The location of these features is shown on Figure 22.5. These features were not surveyed during the 2017 or 2018 Extended Phase 1 Habitat Survey as landowner access could not be agreed, as set out in section 22.5.3. The impacts described in section 22.7 consider the potential impacts on the bat resource within

the 58 moderate or highly suitable linear features (species-rich hedgerows) identified above, and on the potential bat resource present within the unsurveyed areas.

171. All bats are European Protected Species (EPS). Barbastelle, brown long-eared bat, noctule and soprano pipistrelle are all Norfolk LBAP priority species.
172. As EPS, all bat species are considered to be of high importance.

22.6.5.3 Water vole

22.6.5.3.1 Desk study

173. NBIS holds six records for water vole within 2km of the onshore project area. These records are located within the North Walsham and Dilham Canal and within the Pigney's Wood LNR (TN347, Figure 22.5).

22.6.5.3.2 Field survey

174. During the 2018 and 2017 Extended Phase 1 Habitat Surveys, 59 watercourses were assessed for their suitability to support water voles. Of these, 52 were assessed as being of optimal habitat and the remaining seven were assessed as being sub-optimal. An additional two watercourses were subsequently identified and assessed as optimal water vole habitat following the 2017 water vole survey. Therefore, a total of 54 watercourses were scoped in for water vole presence/absence surveys.
175. Those watercourses assessed as sub-optimal were assessed as such primarily due to the watercourse having very little bank for burrowing, noted as being of very poor water quality, very shallow banks, low flows, evidence of regular channel maintenance or isolation from any connecting habitat. Watercourses assessed as sub-optimal were not subject to further surveys.
176. Following route refinement since the 2017 Extended Phase 1 Habitat Survey was undertaken, 38 of the 54 watercourses are within the habitat and species study area and therefore required a water vole presence/absence survey to be undertaken. The remaining sub-optimal watercourses were scoped out and no further survey was undertaken.
177. A water vole survey was undertaken on 34 of the 38 watercourses during both 2017 and 2018. The remaining four watercourses were not surveyed due to landowner access not being obtained at the time of the 2017 and 2018 water vole surveys.
178. Water voles were recorded in nine of the 34 surveyed watercourses, eight of which are located within the onshore project area. Table 22.16 provides details of those watercourses where presence was recorded. The location of these watercourses is shown on Figure 22.7. Full results to date from the water vole survey are presented

in Appendix 22.3.

179. A further three watercourses were identified by the Norfolk Living Map as suitable for water vole. These watercourses were not surveyed for water vole in 2017 and 2018 as landowner access could not be agreed, as set out in section 22.5.3. The impacts described in section 22.7 consider the potential impacts on the water vole resource found, and on the potential resource present within the unsurveyed areas.

Table 22.16 Water vole survey results (as shown in Figure 22.7)

Water-course	Location	Maximum number of latrines within a 100m section	Other field signs ¹¹	Highest population density recorded within watercourse
WV05	Within the habitat and species study area	0	Yes	Low
WV13	Within the onshore project area	0	Yes	Low
WV14	Within the onshore project area	0	Yes	Low
WV15	Within the onshore project area	2	Yes	Low
WV32	Within the onshore project area	15	Yes	High
WV22	Within the onshore project area	0	Yes	Low
NB-WV01	Within the onshore project area	1	Yes	Low
NB-WV07	Within the onshore project area	0	Yes	Low
NB-WV10	Within the onshore project area	0	Yes	Low

180. The one watercourse where a high population density of water voles has been recorded is the River Wensum (WV32), as shown on Figure 22.7.
181. Water voles are protected under the Wildlife and Countryside Act 1981 (as amended) and are a Norfolk LBAP priority species.
182. As a nationally important species which is threatened in the region, water voles are

¹¹ i.e. burrows, feeding stations, runs, prints

considered to be of medium importance.

22.6.5.4 Otter

22.6.5.4.1 Desk study

183. NBIS holds two records for otter within 2km of the onshore project area. These records are shown within the North Walsham and Dilham Canal and within the Pigney's Wood LNR (TN347, Figure 22.5).

22.6.5.4.2 Field survey

184. During the 2017 and 2018 Extended Phase 1 Habitat Surveys, 59 watercourses were assessed for their suitability to support otters. Of these, seven were assessed as being suitable for commuting and foraging otter as they were running watercourses of sufficient depth and size, functionally connected to the local river network. These watercourses are:

- WV13 (Wending Beck);
- WV15 (Penny Spot Beck);
- WV32 (River Wensum);
- WV22 (River Bure);
- WV23 (King's Beck);
- WV24 (drain adjoining King's Beck); and
- WV27 (North Walsham and Dilham Canal).

185. The remaining 52 watercourses were scoped out of further assessment.

186. Suitable otter resting habitat was also observed in the woodland on the left hand bank of the River Bure, within the survey area (TN283), as shown on Figure 22.5 and Figure 22.7. Feeding remains and a potential holt was also observed adjacent to the River Bure (NB-TN39). Potential otter resting sites were also noted at TN12 and TN254, although no field signs were observed at these sites.

187. Field signs of otter were searched for during the 2017 and 2018 water vole surveys. Otter spraints were found in two locations, at WV15 (tributary of the River Wensum) and at WV22 (the River Bure), as shown on Figure 22.7.

188. No further watercourses within the unsurveyed areas were identified by the Norfolk Living Map as being suitable for otter. As such the survey data collected to date for otters is considered sufficient to characterise the baseline environment.

189. Otter are an EPS and are a Norfolk LBAP priority species.

190. As an EPS, otters are considered to be of high importance.

22.6.5.5 Great crested newt

22.6.5.5.1 Desk study

191. NBIS returned no records of great crested newt within 2km of the onshore project area. However, great crested newts are known to be present within 2km of the search area from ecological surveys undertaken for other projects, namely Dudgeon Offshore Wind Farm (Dudgeon Offshore Wind Limited, 2009).

22.6.5.5.2 Field survey

192. A total of 220 standing water bodies are located within the great crested newt study area defined within section 22.5.1 (of which 19 are located within – or immediately adjacent to - the onshore project area).

193. During the 2017 and 2018 Extended Phase 1 Habitat Surveys, 121 of these were subject to a Habitat Suitability Index (HSI) assessment following the methodology devised by Oldham *et al.* (2000) to determine their suitability to support great crested newts. The remaining 99 standing water bodies are located within the great crested newt study area, but could not be surveyed as landowner access was not forthcoming.

194. Part of the terrestrial habitat suitability assessment includes an assessment of the habitat surrounding a potential breeding pond for its suitability to support foraging and hibernating newts. Suitable terrestrial habitat for supporting foraging and hibernating great crested newts was observed throughout the survey area.

195. Forty-nine of these standing water bodies were identified during the HSI assessment as suitable for supporting great crested newts. Of these, 28 were subject to great crested newt presence/absence surveys to determine the presence/likely absence of great crested newts in 2017 and 2018 (herein ‘the 2017 and 2018 great crested newts surveys’). The remaining 21 standing water bodies could not be surveyed as landowner access was not forthcoming.

196. The 2017 and 2018 great crested newts surveys identified 4 standing water bodies as supporting breeding populations of great crested newts, and the remaining 24 standing water bodies as ‘likely absent’ of great crested newts.

Table 22.17 Water bodies with great crested newt presence within the great crested newt study area

Water body	Peak adult count using any method	Eggs found	Population size class assessment	Metapopulation
TF9010-50	2	No	Small	Metapopulation 1
TF9614-154	1	Yes	Small	Metapopulation 2

Water body	Peak adult count using any method	Eggs found	Population size class assessment	Metapopulation
TF9614-155	12	No	Medium	Metapopulation 2
TF0721-256	3	No	Small	Metapopulation 3

197. Six water bodies located within the onshore project area and a further 114 water bodies identified within the great crested newt study area have not been surveyed for great crested newts as landowner access could not be agreed, as set out in section 22.5.3. Approximately 45% of the water bodies located within the great crested newt study area have therefore been surveyed to date. The impacts described in section 22.7 consider the potential impacts on the great crested newt resource found, and on the potential resource present within the unsurveyed areas.

198. Great crested newts are an EPS and a Norfolk LBAP priority species.

199. As an EPS, great crested newts are considered to be of high importance.

22.6.5.6 Reptiles

22.6.5.6.1 Desk study

200. NBIS returned three records for common lizard and grass snake within 2km of the onshore project area, located near Necton and Blickling.

22.6.5.6.2 Field survey

201. During the 2017 and 2018 Extended Phase 1 Habitat Surveys, 22 areas of suitable habitat mosaics were identified as potentially being suitable to support common species of reptiles within the onshore project area. These are located at TN117, TN140, TN141, TN163, TN173, TN196, TN199, TN204, TN224, TN231, TN277, TN289, TN315, TN358, TN374, TN399, NB-TN11, NB-TN13, NB-TN21, NB-TN24, NB-TN35 and NB-TN49. The locations of these areas are shown on Figure 22.5. These mosaics contain a range of habitats, including wet and tussocky grassland with long sward, watercourses, debris piles and leaf litter, woodland edges and scrub. A further suitable location was identified during the 2017 reptile presence / absence survey at plantation woodland near Salle (NGR: TG120242).

202. Following refinement during the site selection process, only 21 of these 22 habitat mosaics are now located within the habitat and species study area.

203. Reptile presence / absence surveys were undertaken during 2017 and 2018 on 19 of the 21 areas. The locations of the reptile presence / absence survey areas are shown in Figure 22.10.

204. Small numbers of common reptiles (1-7 no.) were recorded in seven of the reptile habitat mosaics. Grass snake and slow worm were the only species recorded at any site, and more than one individual was recorded at only NV-RE01, NV-RE21 and NB-RE05. The results of the reptile presence / absence survey are shown in Table 22.18.

Table 22.18 Reptile presence / absence survey results

Reptile habitat mosaic	Species recorded	Peak count (within habitat mosaic)	Location
NV-RE01	Slow worm	6	Within the habitat and species study area
NV-RE04	Slow worm	1	Within the onshore project area (accesses)
NV-RE12	Grass snake	1	Within the onshore project area
NV-RE13	Grass snake	1	Within the onshore project area
NV-RE21	Slow worm	5 (slow worm)	Within the habitat and species study area
	Grass snake	2 (grass snake)	
NB-RE03	Grass snake	1	Within the onshore project area
NB-RE05	Slow worm	2	Within the onshore project area

205. Further details of the 2017 and 2018 reptile presence / absence surveys are presented within Appendix 22.8.

206. A review of the Living Map dataset has identified no potential additional areas of suitable habitat for common reptile species within the unsurveyed areas of the onshore project area. Two locations which were identified during the 2017 Extended Phase 1 Habitat Survey could not be surveyed for reptile presence / absence (NV-RE05 and NV-RE16). These areas have not been surveyed for reptiles as landowner access could not be agreed, as set out in section 22.5.3. The impacts described in section 22.7 consider the potential impacts on the reptiles found, and on the potential resource present within the unsurveyed areas.

207. Reptiles are protected under the Wildlife and Countryside Act 1981 (as amended).

208. As a nationally important species which is rare in the region, reptiles are considered to be of medium importance.

22.6.5.7 White-clawed crayfish

22.6.5.7.1 Desk study

209. NBIS holds no records for white-clawed crayfish within 2km of the onshore project area. Advice received from the Environment Agency indicated that white-clawed

crayfish are not known to be present in any reaches located within the habitat and species study area (Environment Agency, 2017). Further data supplied from the Environment Agency showing the results of the most recent white-clawed crayfish surveys indicates that white-clawed crayfish are not present in the Blackwater, a tributary of the Wensum upstream of the habitat and species study area (Environment Agency, 2018).

- 210. The River Wensum and River Bure are known to support populations of white-clawed crayfish in other reaches (Environment Agency, 2017).
- 211. White-clawed crayfish are an EPS and are a Norfolk LBAP priority species.
- 212. As EPS, white-clawed crayfish are considered to be of high importance.

22.6.5.8 Other invertebrates

22.6.5.8.1 Desk study

- 213. NBIS holds records for 64 notable invertebrates within 2km of the onshore project area, including notable bee, dragonfly, butterfly, moth, cricket and beetle species.
- 214. Of these 64 species, the following invertebrate species are subject to Norfolk Species Action Plans: silver-studded blue butterfly *Plebejus argus*, little-whirlpool ram's-horn snail *Anisus vorticulus*, depressed river mussel *Pseudanodonta complanata*, shining ram's-horn snail *Segmentina nitida*, narrow-mouth whorl snail *Vertigo angustior*, Desmoulin's whorl snail *Vertigo moulinsiana*, ground beetle *Ophonus laticollis*, brush-thighed seed-eater beetle *Harpalus froelichii*, flixweed flea beetle *Psylliodes sophiae* and the Norfolk hawker dragonfly *Anaciaeshna isosceles*.

22.6.5.8.2 Field survey

Desmoulin's whorl snail

- 215. Following consultation with Natural England as part of Norfolk Vanguard EPP (Royal HaskoningDHV, 2016), targeted surveys for the Desmoulin's whorl snail (a qualifying feature of the River Wensum SAC) of the floodplain habitat adjacent to the River Wensum that are within the habitat and species study area were undertaken to understand any potential effects of the project on this species within both the SAC boundary and its associated ditches (see Figure 22.12).
- 216. Desmoulin's whorl snail surveys of the banks of the River Wensum and the ditches of the floodplain on the southern and northern banks of the River Wensum (the '2017 and 2018 Desmoulin's whorl snail survey area') were carried out in August 2017 and August 2018, following the monitoring protocol developed by Killeen and Moorkens (2003). The locations of these surveys are shown in Figure 22.12.

217. Desmoulin's whorl snail was not recorded during any survey, and is therefore considered to be absent from the 2017 and 2018 Desmoulin's whorl snail survey area. Furthermore, no records of Desmoulin's whorl snail were identified during the desk study, indicating that this species has not been recorded within 2km of the onshore project area previously. The full findings of the Desmoulin's whorl snail survey are shown in Appendix 22.6.
218. As a species which is a qualifying feature of the River Wensum SAC, Desmoulin's whorl snail is considered to be of high importance.

Norfolk hawker dragonfly

219. During the 2017 reptile surveys, the Norfolk hawker dragonfly was recorded at one location (TG 20027 28654) along a drainage ditch adjacent to the River Bure on 5th June 2017. This species has not previously been recorded at this location along the River Bure, with the only records returned by NBIS within 2km of the onshore project area being unconfirmed sightings located at Pigney's Wood.
220. The Norfolk hawker is protected under the Wildlife and Countryside Act 1981 (as amended), is listed as 'Endangered' in the Odonata Red Data List and is a Norfolk LBAP priority species.
221. As a nationally important species which is rare in the region, the Norfolk hawker is considered to be of medium importance.
222. Suitable habitats for other notable invertebrates were not identified within the habitat and species study area.

22.6.5.9 Fish

22.6.5.9.1 Desk study

223. NBIS returned no records of notable fish species within 2km of the onshore project area. The Environment Agency National Fish Population Database returned records of the following Annex II fish species (and qualifying features of the River Wensum SAC) within watercourses within the habitat and species study area:
- Bullhead; and
 - Brook lamprey.
224. Records of brown trout *salmo trutta*, a NERC Act 2006 Section 41 species, were also provided.
225. Table 22.19 summarises the National Fish Population Database for each watercourse within the habitat and species study area.

Table 22.19 National Fish Population Database records for bullhead, brook lamprey and brown trout

Watercourse	Catchment	Species recorded	Record location
Wendling Beck	Wensum	Bullhead Brown Trout	Within the habitat and species study area
Penny Spot Beck	Wensum	Bullhead Brown Trout	Within the habitat and species study area
River Wensum	Wensum	Bullhead Brown Trout Brook lamprey	Upstream and downstream of the habitat and species study area
Reepham Stream (western branch)	Wensum	Bullhead	Upstream of the habitat and species study area
Reepham Stream (eastern branch)	Wensum	Bullhead	Upstream of the habitat and species study area
Booton Watercourse	Wensum	Brown trout	Upstream and downstream of the habitat and species study area
River Bure	Bure	Bullhead Brown Trout Brook lamprey	Upstream and downstream of the habitat and species study area
King's Beck		Brown Trout Brook lamprey	Upstream and downstream of the habitat and species study area

226. Bullhead and brook lamprey, as qualifying features of the River Wensum SAC, are considered to be of high importance.

227. As a nationally important species which is uncommon in the region, brown trout is considered to be of medium importance.

22.6.5.10 Protected flora

22.6.5.10.1 Desk study

228. NBIS returned records of the notable plant species holly-leaved naiad *Najas marina* has been recorded within 2km of the onshore project area.

22.6.5.10.2 Field survey

229. No evidence of this species or any other notable plant species was recorded during the 2017 and 2018 Extended Phase 1 Habitat Surveys.
230. Following consultation with Natural England as part of Norfolk Vanguard EPP (Royal HaskoningDHV, 2016), a detailed botanical survey (i.e. NVC survey) of the floodplain habitat adjacent to the River Wensum within the habitat and species study area has been undertaken in order to confirm whether species which comprise the River Wensum SAC designated habitat ‘*Water courses of plain to montane levels with the Ranunculus fluitantis and Callitricho-Batrachion vegetation*’ are present. Surveys were subsequently undertaken in July 2017 and August – September 2018, the aim of which was:
- To identify the NVC communities within the River Wensum SAC;
 - To note if the following plants are growing within the River Wensum or ditches of the adjacent floodplain habitats:
 - pond water-crowfoot *Ranunculus peltatus*;
 - stream water-crowfoot *Ranunculus penicillatus ssp. pseudofluitans*;
 - river water-crowfoot *Ranunculus fluitans*.
 - To identify the NVC communities within the floodplain habitats found adjacent to the River Wensum; and
 - To look for presence of calcareous groundwater springs/seepage within the floodplain habitats.
231. These surveys covered the River Wensum within the SAC boundaries and the floodplain habitat on the right-hand (southern) and left-hand (northern) banks of the River Wensum (herein referred to as the ‘survey area’). The location of these surveys is shown in Figure 22.11. The scope for this survey was set out within the Onshore Ecology and Onshore Ornithology Method Statement and agreed with the Norfolk Boreas ETG in January 2018 (Royal HaskoningDHV, 2018).
232. Two main NVC communities (following Rodwell, 2006) were identified within the stretch of the River Wensum surveyed in July 2017:
- A8a-*Nuphar lutea* community, species-poor sub community; and
 - S5-*Glycerietum maximae* swamp, *Alisma plantago-aquatica-Sparganium erectum* sub community.
233. The semi-improved grassland adjacent to the River Wensum consisted of three main NVC communities (following Rodwell, 2006), which were often transitional to each other:
- MG1 - *Arrhenatherum elatius* grassland *Festuca rubra* sub-community;

- MG6 – *Lolium perenne*-*Cynosus cristatus* grassland; and
 - MG10 – *Holco-Juncetum effusi* rush pasture.
234. Five separate communities (following Doarks and Leach, 1990) were identified within the drain ditches of the River Wensum floodplain within the survey area:
- Aquatic End Group A5b – *Lemna minor*-*Lemna trisulca*-filamentous algae;
 - Aquatic End Group A6 - *Callitriche stagnalis/platycarpa*;
 - Aquatic End Group A7b - *Potamogeton pectinatus*-*Myriophyllum spicatum*;
 - Emergent End Group E1 – *Carex riparia/acutiformis*-*Phragmites australis*;
 - Emergent End Group E2 – *Glyceria Maxima*-*Berula erecta*; and
 - Emergent End Group E3 - *Juncus effusus*.
235. None of the following species, associated with the River Wensum SAC habitat were recorded during the 2017 and 2018 botanical surveys within the River Wensum or its floodplain: *R. peltatus*, *R. penicillatus ssp. pseudofluitans* or *R. fluitans*.
236. There was no evidence of calcareous groundwater spring or seepage activity with the survey area.
237. The full findings of the 2017 and 2018 botanical surveys are shown in Appendix 22.7.
238. As species which support the Annex 1 habitat *Water courses of plain to montane levels with the Ranunculion fluitantis and Callitriche-Batrachion vegetation* these are considered to be of high importance.

22.6.5.11 Invasive non-native species

22.6.5.11.1 Desk study

239. NBIS returned records of a number of different invasive non-native species within 2km of the onshore project area:
- Japanese knotweed *Fallopia japonica* has been recorded at three locations, including Drabblegate, Aylsham and Burnt Fen Cottages;
 - American mink *Neovison vison* have been recorded at five locations along the River Wensum; and
 - Signal crayfish *Pacifastacus leniusculus* have been recorded at two locations at Park Farm on the River Wensum and on Booton Watercourse.
240. The Environment Agency provided records from 1989-present indicating that signal crayfish are present in the following watercourses within the habitat and species study area:
- Blackwater drain;
 - Reepham Stream;
 - River Wensum; and

- Wendling Beck.

241. Records have been found within the onshore cable route at the Blackwater Drain at Salle (NGR: TG 12530 24550).

22.6.5.11.2 Field survey

242. During the 2017 and 2018 Extended Phase 1 Habitat Surveys, non-native invasive species were recorded at two locations:

- One established patch of Japanese knotweed, approximately 30m² in area, was identified within the survey area at TN291; and
- One patch of giant hogweed *Heracleum mantegazzianum* at TN29 (see Figure 22.5).

243. These locations are shown on Figure 22.5.

244. Signal crayfish were also recorded in the River Wensum during the 2017 botanical survey within the habitat and species study area and along the River Bure (as otter feeding remains) during the 2018 Extended Phase 1 Habitat Survey.

245. The 2017 and 2018 Extended Phase 1 Habitat Surveys was conducted outside the optimum season for identifying other invasive flora species; therefore, invasive flora species may have been present and not noted during the field survey.

246. Invasive species are listed in Schedule 9 of the Wildlife and Countryside Act 1981 (as amended).

247. As the risk posed by these species is of national importance, these species are considered to be of medium importance.

22.6.6 Biodiversity

248. Following the publication of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, an EclA must consider the potential impact not upon 'flora and fauna' but instead upon 'biodiversity, with particular attention to species and habitats protected under the Habitats Directive and Birds Directive'. This EclA has considered potential impacts upon biodiversity through considering the potential impacts on those sites, habitats and species protected through EU and UK law or through local policy, as representing the elements of UK biodiversity most at risk of loss, isolation or degradation.

22.6.7 Anticipated Trends in Baseline Conditions

249. The ecological baseline described in the preceding sections provides a summary of the habitats and species present within the study areas. In broad terms, the study

areas represent typical lowland UK habitat types largely comprised of arable farmland with hedgerows, with pockets of woodland, wetland and standing and flowing water. Within this habitat mosaic, the key habitats for notable species are typically designated sites and parcels of woodland and wetland, with species in other areas relying strongly on ecological corridors such as watercourses and hedgerows between arable farmland.

250. The overall trend in the UK is for a decline in priority species since the 1970s, although the gradient of this decline has lessened since 2000 (Defra, 2017). This overall trend is driven by certain species groups, with moths in particular declining by approximately 80% over this period (Defra, 2017). Habitat connectivity has remained static since 1990, and indicators of ecosystems services provision (pollinators) have also remained static over the short term. Perhaps most relevant to the study areas, species associated with farmland have declined over the short and long term, with farmland birds and butterflies both declining, whilst mammal (bats) numbers increased from 1999-2015, but the increase has levelled out from the period 2010-2015 (Defra, 2017).
251. Attempts to manage trends in biodiversity are delivered through EU, UK and local legislation and policies. The UK has transposed protection for European protected species and habitats into UK law¹², and also provides domestic legislation for species and sites not covered by European protection. The UK's approach to managing Biodiversity Loss is set by *Biodiversity 2020: a strategy for England's wildlife and ecosystem services* (Defra, 2011). The policies set out under this strategy seek to reverse these declining trends. Data is still being gathered to determine success of these measures, however for the time being it appears that declining trends in biodiversity for the habitats and species present within the study areas may continue. As a consequence, it is assumed that the ecological baseline within the study areas will continue to change over time as measures to try and manage the decline in protected species and habitats continue.

22.7 Potential Impacts

252. The following sections describe the impacts upon those ecological receptors described in section 22.6 predicted to arise as a result of the construction, operation and decommissioning phases of the project, following the methodology set out in section 22.4. Information on the embedded mitigation which has already been included in the project, and on the project worst case assumptions against which the assessment is undertaken, is also included.

¹² These species will continue to be protected under the European Union (Withdrawal) Act 2018, which ensures that the domestic legislation which transposes EU Directives protecting habitats and species into UK law is retained following the UK's exit from the EU.

253. The EclA is being undertaken for the following two alternative scenarios therefore an assessment of potential impacts has been undertaken for each scenario:
- **Scenario 1** – Norfolk Vanguard proceeds to construction, and installs ducts and other shared enabling works for Norfolk Boreas.
 - **Scenario 2** – Norfolk Vanguard does not proceed to construction and Norfolk Boreas proceeds alone. Norfolk Boreas undertakes all works required as an independent project.
254. Where the assessment of the impact is different for Scenario 1 and Scenario 2 a separate assessment is presented under each impact heading. Where this is relevant, Scenario 2 is presented first as it would generally result in the more significant impacts.

22.7.1 Embedded Mitigation

255. Norfolk Boreas Limited has committed to a number of techniques and engineering designs/modifications inherent as part of the project, during the pre-application phase, in order to avoid a number of impacts or reduce impacts as far as possible. Embedding mitigation into the project design is a type of primary mitigation and is an inherent aspect of the EIA process.
256. A range of different information sources have been considered as part of embedding mitigation into the design of the project (for further details see Chapter 4 Site Selection and Assessment of Alternatives, Chapter 5 Project Description, and Chapter 7 Technical Consultation) including engineering requirements, feedback from the community and landowners, ongoing discussions with stakeholders and regulators, commercial considerations and environmental best practice.
257. The following sections outline the key embedded mitigation measures relevant for this assessment. These measures are presented in Table 22.20. Where embedded mitigation measures have been developed into the design of the project with specific regard to onshore ecology, these are described in Table 22.21.

Table 22.20 Embedded mitigation

Parameter	Mitigation measures embedded into the project design	Notes
Project Wide		
Commitment to HVDC technology	Commitment to HVDC technology minimises environmental impacts through the following design considerations; <ul style="list-style-type: none"> • HVDC requires fewer cables than the HVAC solution. During the duct installation phase this reduces the cable route working width for Norfolk Boreas to 35m from the previously identified worst case of 50m. As a result, the overall footprint of the onshore cable 	Norfolk Boreas Limited has reviewed consultation received and in light of the feedback, has made a number of decisions in relation to the project design. One of these decisions is to

Parameter	Mitigation measures embedded into the project design	Notes
	<p>route required for the duct installation phase is reduced from approx. 300ha to 210ha;</p> <ul style="list-style-type: none"> • The width of permanent cable easement is also reduced from 25m to 13m; • Removes the requirement for a cable relay station as permanent above ground infrastructure; • Reduces the maximum duration of the cable pulling phase from three years down to two years; • Reduces the total number of jointing pits for Norfolk Boreas from 450 to 150; and • Reduces the number of drills needed at trenchless crossings (including landfall). 	<p>deploy HVDC technology as the export system.</p>
<p>Site Selection</p>	<p>The project has undergone an extensive site selection process which has involved incorporating environmental considerations in collaboration with the engineering design requirements. Considerations include (but are not limited to) adhering to the Horlock Rules for onshore project substations and Necton National Grid extension and associated infrastructure, a preference for the shortest route length (where practical) and developing construction methodologies to minimise potential impacts.</p> <p>Key design principles from the outset were followed (wherever practical) and further refined during the EIA process, including;</p> <ul style="list-style-type: none"> • Avoiding proximity to residential dwellings; • Avoiding proximity to historic buildings; • Avoiding designated sites; • Minimising impacts to local residents in relation to access to services and road usage, including footpath closures; • Utilising open agricultural land, therefore reducing road carriageway works; • Minimising requirement for complex crossing arrangements, e.g. road, river and rail crossings; • Avoiding areas of important habitat, trees, ponds and agricultural ditches; • Installing cables in flat terrain maintaining a straight route where possible for ease of pulling cables through ducts; • Avoiding other services (e.g. gas pipelines) but aiming to cross at close to right angles where crossings are required; • Minimising the number of hedgerow crossings, utilising existing gaps in field boundaries; • Avoiding rendering parcels of agricultural land inaccessible; and • Utilising and upgrading existing accesses where possible to avoid impacting undisturbed ground. 	<p>Constraints mapping and sensitive site selection to avoid a number of impacts, or to reduce impacts as far as possible, is a type of primary mitigation and is an inherent aspect of the EIA process. Norfolk Boreas Limited has reviewed consultation received to inform the site selection process (including from local communities, landowners and regulators) and in response to feedback, has made a number of decisions in relation to the siting of project infrastructure. The site selection process is set out in Chapter 4 Site Selection and Assessment of Alternatives.</p>

Parameter	Mitigation measures embedded into the project design	Notes
Long HDD at landfall	Use of long HDD at landfall to avoid restrictions or closures to Happisburgh beach and retain open access to the beach during construction. Norfolk Boreas Limited have also agreed to not use the beach car park at Happisburgh South.	Norfolk Boreas Limited has reviewed consultation received and in response to feedback, has made a number of decisions in relation to the project design. One of those decisions is to use long HDD at landfall.
Scenario 1		
Strategic approach to delivering Norfolk Boreas and Norfolk Vanguard	<p>Under Scenario 1, onshore ducts will be installed for both projects at the same time, as part of the Norfolk Vanguard construction works. This would allow the main civil works for the cable route to be completed in one construction period and in advance of cable delivery, preventing the requirement to reopen the land in order to minimise disruption. Onshore cables would then be pulled through the pre-installed ducts in a phased approach at later stages.</p> <p>In accordance with the Horlock Rules, the co-location of Norfolk Boreas and Norfolk Vanguard onshore project substations will keep these developments contained within a localised area and, in so doing, will contain the extent of potential impacts.</p>	The strategic approach to delivering Norfolk Boreas and Norfolk Vanguard in order to minimise environmental impacts has been a consideration from the outset.
Scenario 2		
Duct Installation Strategy	Under Scenario 2, the onshore cable duct installation strategy is to install ducts in sections to minimise impacts. Construction teams would work on a short section (approximately 150m length) and once the cable ducts have been installed, the section would be back filled and the top soil reinstated before moving onto the next section. This would minimise the amount of land being worked on at any one time and would also minimise the duration of works on any given section of the route.	This has been a very early project commitment. Chapter 5 Project Description provides a detailed description of the process.
Trenchless Crossings	<p>Commitment to trenchless crossing techniques to minimise impacts to the following specific features;</p> <ul style="list-style-type: none"> • Wendling Carr County Wildlife Site; • Little Wood County Wildlife Site; • Land South of Dillington Carr County Wildlife Site; • Kerdiston proposed County Wildlife Site; • Marriott's Way County Wildlife Site / Public Right of Way (PRoW); • Paston Way and Knapton Cutting County Wildlife Site; • Norfolk Coast Path; • Witton Hall Plantation along Old Hall Road; • King's Beck; 	A commitment to a number of trenchless crossings at certain sensitive locations was identified at the outset. However, Norfolk Boreas Limited has committed to certain additional trenchless crossings as a direct response to stakeholder requests.

Parameter	Mitigation measures embedded into the project design	Notes
	<ul style="list-style-type: none"> • River Wensum; • River Bure; • Wendling Beck; • Wendling Carr; • North Walsham and Dilham Canal; • Network Rail line at North Walsham that runs from Norwich to Cromer; • Mid-Norfolk Railway line at Dereham that runs from Wymondham to North Elmham; and • Trunk Roads including A47, A140, A149. 	

Table 22.21 Embedded mitigation for onshore ecology

Parameter	Mitigation measures embedded for onshore ecology	Notes
Designated sites	<p>Constraints mapping was undertaken prior to the publication of the Norfolk Vanguard EIA Scoping Report (Royal HaskoningDHV, 2016). This exercise was used to determine the route options for the onshore project area for the project. The following ecological receptors were considered as part of the constraints mapping process:</p> <ul style="list-style-type: none"> • International designated sites for nature conservation (SAC, SPA, Ramsar sites); • National designated sites for nature conservation (The Broads National Park, SSSI, NNR, LNR); and • Ancient woodland. <p>These ecological receptors have been avoided during the onshore project area route selection process.</p>	More information can be found in Chapter 4 Site Selection and Assessment of Alternatives.
Route Refinement	<p>Route refinements have included consideration of more detailed ecological constraints, and the following principles have been applied when refining the onshore project area:</p> <ul style="list-style-type: none"> • Ancient woodland – following the Forestry Commission’s Standing Advice on Ancient Woodland and Veteran Trees, a buffer of 15m around all ancient woodlands has been used (Forestry Commission, 2014); • Woodland – areas of woodland have been avoided where possible during the route selection process; • Habitat – standing water bodies, trees, and agricultural ditches have been avoided where possible; and • Hedgerows – the number of hedgerow crossings has been minimised as far as possible, taking other fixed constraints into account. 	Further information on the route refinement process can be found in Chapter 4 Site Selection and Assessment of Alternatives.

Parameter	Mitigation measures embedded for onshore ecology	Notes
Hedgerow and watercourse crossings	<p>The working width at hedgerow and watercourse crossings is 13m¹³ (reduced from 25m) due to the selection of a HVDC electrical solution.</p> <p>Where hedgerow gaps are required beyond the two-year duct installation phase (i.e. for the duration of the subsequent two-year cable pulling phase), the number of gaps required will be minimised as far as possible and will be no wider than 6m.</p>	Further information can be found in Chapter 5 Project Description.
County Wildlife Sites	<p>In response to comments from stakeholders raised as part of the Norfolk Vanguard EPP, Norfolk Boreas Limited is proposing to use trenchless crossing techniques (e.g. HDD) at all CWS and proposed CWS crossed by the onshore project area in order to minimise the impacts upon the habitats contained within these sites.</p> <p>This includes proposed trenchless crossing techniques (e.g. HDD) at the following locations:</p> <ul style="list-style-type: none"> • Wendling Carr CWS (CWS no. 1013); • Little Wood CWS (CWS no. 2024), • Land South of Dillington Carr CWS (CWS no. 1025), • Kerdiston proposed CWS (no CWS number); • Marriott's Way CWS (CWS no. 2176) (in two locations); and • Paston Way and Knapton Cutting CWS (CWS no. 1175). <p>At five of these six locations, no works will be undertaken within the CWS boundary.</p>	<p>Further information on trenchless crossing techniques can be found in Chapter 5 Project Description.</p> <p>At one location, Wendling Carr CWS, only a temporary running track will be required to pass through the CWS. This will be a 6m by up to 180m track located within the CWS. This is shown on Figure 22.3.</p>
Construction Programme	<p>The construction programme for the onshore cables has been designed to minimise the duration and extent of impacts to ecological receptors at any given location along the onshore cable route.</p> <p>Specifically:</p> <ul style="list-style-type: none"> • During the two-year duct installation phase (under Scenario 2 only), each duct installation team will work along a short section of the cable route, approximately 150m at a time. Where possible, each 150m workforce (approximately 0.7ha in area) will be reinstated following duct installation, before works commence on the next section. The works at each section, including reinstatement, will take approximately one week (up to two in a worst case). Within each section, a 6m wide strip will be retained for the running track, for up to the remainder of the two-year duct installation phase (i.e. as a worst case a 60km by 6m strip along the onshore 	For further details on the construction approach and programme, please see Chapter 5 Project Description.

¹³ This width assumes that the onshore cable route bisects each hedgerow in a perpendicular fashion. In reality, some hedgerows will be crossed at an angle, therefore increasing the maximum width of the gap required up to a possible 16.5m. Where this is the case for a particular receptor, it is noted within this report.

Parameter	Mitigation measures embedded for onshore ecology	Notes
	<p>cable route will be lost for the duration of the cable duct installation);</p> <ul style="list-style-type: none"> • During the two year cable pulling phase, a reduced 12km by 6m strip along the onshore cable route is anticipated to be lost potentially for a further 16 weeks in any one area per annum for the running track, thus minimising the number of hedgerow gaps required for the duration of construction down to approximately 20%. The hedgerow gap has also been reduced to the width of the running track (6m) for the cable pull; and • The majority of disturbance to watercourses will only occur during the two-year duct installation phase. Once the ducts are in the ground, subsequent cable pulling operations will not result in further disturbance to watercourses. There may be disturbance to a small number of watercourses which need to be crossed when the running track is reinstated to facilitate the cable pulling operations. 	
Strategic landscape mitigation	Mitigation measures associated with the onshore project substation, National Grid substation extension and access from the A47 form part of a strategic approach to enhancing landscape character and biodiversity in the local area. Figure 29.11 (Scenario 1) and Figure 29.22 (Scenario 2) in Chapter 29 Landscape and Visual Impact Assessment shows how mitigation planting will contribute to the wider landscape structure of the area and help consolidate green corridors for wildlife.	For further details on project landscaping, please see Chapter 29 Landscape and Visual Impact Assessment.

22.7.2 Outline Landscape and Environmental Management Strategy

258. The mitigation measures set out within this EclA will be delivered via an Outline Landscape and Environmental Management Strategy (OLEMS) (document reference 8.7). This document, submitted alongside the ES as part of the DCO application, is the primary document detailing the ecological mitigation measures required in order to ensure that all potential impacts identified within this EclA are reduced to a non-significant level. The document encapsulates those mitigation measures proposed for individual ecological receptors within this EclA and sets out how they will fit into the wider approach to managing landscape impacts during construction and operation of the project.
259. The OLEMS aims to ensure that all mitigation proposed within this EclA is part of an integrated management strategy which will ensure that adverse impacts upon biodiversity and ecological networks are not treated in isolation.
260. As outlined in section 22.5.3, access for the full survey extent was not possible in 2017 or 2018 (access has been possible to approximately 65% of the field survey study area). As a consequence, the detailed mitigation measures which will be included within the OLEMS for these inaccessible areas have been based on a precautionary, non-specific approach and the requirement that further post-consent

surveys for these unsurveyed areas will be undertaken. The OLEMS therefore provides a route map of how potential ecological impacts in those inaccessible areas will be managed.

261. Chapter 29 Landscape and Visual Impact Assessment includes details of mitigation planting schemes for the proposed permanent works at the onshore substation. These have been developed in consultation with Norfolk County Council, and these requirements will be included within the OLEMS.

22.7.3 Monitoring

262. The development of the detailed design and Code of Construction Practice (CoCP) (DCO Requirement 20), post consent, will refine the worst-case impacts assessed in this EclA. It is recognised that monitoring is an important element in the management and verification of the actual project impacts. The requirement for, and the appropriate design and scope of, monitoring will be agreed with the appropriate stakeholders and included within the CoCP and the Ecological Management Plan (which will be based on the OLEMS). An outline CoCP (document reference 8.1) has been submitted as part of the DCO application.

22.7.4 Worst Case

263. The EclA has used the Rochdale Envelope principle and assessed impacts against defined project worst case assumptions.
264. This section sets out the worst case assumptions with respect to onshore ecology. The worst case assumptions include the parameters of the different potential construction options for the project which would result in the greatest potential impact upon the ecological receptors described in section 22.6. Chapter 5 Project Description sets out the details of the project.
265. Table 22.22 sets out those parameters which comprise the worst case assumptions for onshore ecology under Scenario 1, and Table 22.23 sets out those parameters which comprise the worst case assumptions for onshore ecology under Scenario 2.

Table 22.22 Worst case assumptions – Scenario 1

Worst case assumptions			
Parameter	Worst case criteria	Worst case definition	Notes
Landfall			
Construction	Method	Trenchless technique (e.g. HDD)	Worst case construction noise levels and vibration levels are as set out within Chapter 25 Noise and Vibration.
	Maximum drill length	1,000m	
	Temporary works footprint	6,000m ²	

Worst case assumptions			
Parameter	Worst case criteria	Worst case definition	Notes
	Maximum temporary works duration	20 weeks	Based on 7am-7pm normal working hours. 7 days a week.
Landfall compounds	Maximum number and maximum land take for temporary landfall compounds	6,000m ²	Assumes two compounds at 3,000m ² (each 50m x 60m) to support parallel drilling rigs.
Onshore cable route			
Construction (cable pulling only)	Cable pulling maximum footprint	85,500m ²	Cable pulling footprint include the running track and jointing pits.
	Gaps at hedgerow / other crossing points	6m	Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration.
	Excavated material for running track	21,600m ³	
Permanent jointing pits	Maximum number and required dimensions	Assume 150 at 90m ² and 2m deep each	Dimension 6m (w) x 15m (l). Spaced approximately one per circuit per 800m cable.
Construction programme – cable pulling works	Jointing pit/hardstand area	10 weeks	In any one area per annum during the 2 year cable pulling phase.
	Running track	16 weeks	
	Total construction window	2 years	2 years phased cable pulling works
Decommissioning		Jointing pits and ducts left in-situ	Where cables are in pre-installed ducts, cables may be extracted once de-energised.
Onshore project substation			
Construction	Maximum land take for construction works at the onshore project substation	95,000m ²	Operational area for substation (250m x 300m) plus temporary construction compound (200m x 100m).
	Maximum land take for temporary works area at Spicers Corner	10,000m ²	Spicers corner compound 100m x 100m.
	Maximum duration	30 months	Indicative construction window 24 months Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration.
Operation	Maximum land take for permanent footprint	75,000m ²	Operational footprint 250m x 300m
	Access	One visit per week	Site lighting required during maintenance visits

Worst case assumptions			
Parameter	Worst case criteria	Worst case definition	Notes
			Worst case operational noise levels are as set out within Chapter 25 Noise and Vibration.
Decommissioning	No decision has been made regarding the final decommissioning policy for the onshore project substation, as it is recognised that industry best practice, rules and legislation change over time. However, the onshore project equipment will likely be removed and reused or recycled. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, for the purposes of a worst case, impacts as for the construction phase are assumed.		
National Grid extension and overhead line modification			
Construction	Maximum land take for construction works at substation extension	95,250m ²	Operational area (135m x 150m) plus temporary compound adjacent to eastern extension site (150m x 200m) and compound adjacent to the Norfolk Vanguard Extension (300m x 150m).
	Maximum duration	30 months	Indicative construction timing 24 months Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration.
Operation	Maximum land take for substation extension permanent footprint	20,250m ²	Permanent eastern extension footprint 135m x 150m
	Access	1 visit per month	Site lighting required during maintenance visits

Table 22.23 Worst case assumptions – Scenario 2

Worst case assumptions			
Parameter	Worst case criteria	Worst case definition	Notes
Landfall			
Construction	Method	Trenchless technique (e.g. HDD)	Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration.
	Maximum drill length	1,000m	
	Temporary works footprint	6,000m ²	
	Maximum temporary works duration	20 weeks	
Landfall compounds	Maximum number and maximum land take for temporary landfall compounds	6,000m ² each to support parallel drill rigs	Assumes two compounds at 3,000m ² (each 50m x 60m) to support parallel drilling rigs

Worst case assumptions			
Parameter	Worst case criteria	Worst case definition	Notes
Onshore cable route			
Construction	Construction method	Open cut trenching and trenchless crossing methods	Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration. Total duct installation footprint includes the onshore cable route footprint plus all associated works footprints (mobilisation areas, trenchless launch and reception sites).
	Maximum working width and length	35m and 60km	
	Onshore cable route maximum footprint	2,100,000m ²	
	Total maximum duct installation footprint	2,452,500m ²	
	Gaps at hedgerow / other crossing points	13m ¹⁴	
	Maximum hedgerows to be removed	165 ¹⁵	
	Running track excavated material	108,000m ³	
	Trench excavated material	180,000m ³	
	Cable pulling maximum footprint	85,500m ²	Cable pulling footprints include the running track and jointing pit.
Permanent jointing pits	Maximum number and required dimensions	Assume 150 at 90m ² and 2m deep each	Dimension 6m (w) x 15m (l). Spaced approximately one per circuit per 800m cable.
Mobilisation areas	Maximum number and required dimensions	Assumes 14 at 10,000m ²	Including area at Spicers Corner
Trenchless launch and reception sites	Maximum number and maximum land take for	Assumes 16 pairs at 7,500m ² and 5,000m ²	Assumed to be up to 150m x 50m and 100m x 50m

¹⁴ The gap at hedgerows is indicative, depending on the angle of crossing. This width assumes that the onshore cable route bisects each hedgerow in a perpendicular fashion. In reality, some hedgerows will be crossed at an angle, therefore increasing the maximum width of the gap required up to a possible 16.5m. Where this is the case for a particular receptor, it is noted within this report. Mitigation by design with respect to hedgerows already included in Chapter 5 Project Description.

¹⁵ Hedgerows estimated based on 110 hedgerows surveyed within the onshore infrastructure plus a further 55 identified from the Norfolk Living Map and aerial photography taken in 2017. The final number of hedgerows to be removed will be determined during surveys of the unsurveyed areas post-consent when access becomes available.

Worst case assumptions			
Parameter	Worst case criteria	Worst case definition	Notes
	trenchless launch and reception sites		
Construction programme - ducting	Ducting at any 150m workfront	2 weeks	Where considered necessary, hedgerows will be reinstated immediately after each duct installation, with a small number left open to facilitate access for cable pulling. As the locations of these openings are not available at this time, the WCS assumes at this stage that no hedgerows will be reinstated during the construction phase, i.e. between trenching and cable pulling.
	Trenchless works at each watercourse	8 weeks	
	Running track topsoil storage area	2 years	
	Total construction window	2 years	
Construction programme - cable pulling works	Hardstanding area	10 weeks	In any one area per annum during the 2 year cable pulling phase.
	Running track topsoil storage area	16 weeks	
	Total construction window	2 years	
Construction programme	Total construction window	6 years	Includes 2 years pre-construction works.
Decommissioning		Jointing pits and ducts left in-situ	Where cables are in pre-installed ducts, cables may be extracted once de-energised.
Onshore project substation			
Construction	Maximum land take for construction works for onshore project substation	95,000m ²	Operational area for substation (250m x 300m) plus temporary construction compound (200m x 100m).
	Maximum duration	30 months	Indicative construction timing 24 months. Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration.
Operation	Maximum land take for permanent footprint Access	75,000m ² One visit per week, site lighting required during maintenance visits	Operational footprint 250m x 300m. Worst case operational noise levels are as set out within Chapter 25 Noise and Vibration.
Decommissioning	No decision has been made regarding the final decommissioning policy for the onshore project substation, as it is recognised that industry best practice, rules and legislation change over time. However, the onshore project equipment will likely be removed and reused or recycled. The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be		

Worst case assumptions			
Parameter	Worst case criteria	Worst case definition	Notes
			provided. As such, for the purposes of a worst case, impacts as for the construction phase are assumed.
National Grid extension and overhead line modification			
Construction	Maximum land take for construction works at substation extension	97,500m ²	Operational area (200m x 150m) plus temporary compounds (150m x 150m and 300m x 150m).
	Maximum land take for temporary works area – overhead line	176,310m ²	
	Maximum duration	30 months	Indicative construction window 24 months Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration.
Operation	Maximum land take for substation extension permanent footprint	30,000m ²	Permanent western extension footprint 200m x 150m
	Maximum land take for overhead line permanent footprint	Up to 1,000m ²	
	Access	1 visit per month	Site lighting required during maintenance visits

266. Chapter 5 Project Description outlines the timings to be assessed in relation to the phasing of the works. In all cases for onshore ecology; the two phase option, where cables are installed in two consecutive years to facilitate the commissioning of the offshore wind turbine planting, is assumed to be the worst case. This is due to the increased length of time that ecological receptors will be potentially impacted by the project.

22.7.5 Potential Impacts during Construction

22.7.5.1 Impact 1: Statutory designated sites

22.7.5.1.1 Scenario 1 and Scenario 2

Landfall

267. There are no terrestrial ecology statutory designated sites within 2km of the landfall location. As such there will be no change upon statutory designated sites due to the proposed project landfall works under either scenario.

22.7.5.1.2 Scenario 2

Onshore cable route

268. There are 37 terrestrial statutory designated sites within 2km of the onshore cable route (of which 20 are ancient woodlands, see Figure 22.2). Following embedded mitigation to avoid statutory designated sites during the site selection process, only two designated sites, namely the River Wensum SAC and SSSI and Old Carr ancient woodland, are located within the onshore cable route. The remaining 35 sites have been avoided entirely and therefore no direct impacts on these sites will occur.
269. The following designated sites are located within 500m of the onshore cable route, and have therefore been considered further due to the potential for indirect effects upon these sites to occur:
- River Wensum SSSI and SAC;
 - Dillington Carr, Gressenhall SSSI;
 - Dereham Rush Meadow SSSI;
 - Pigney's Wood LNR; and
 - The following ancient woodlands:
 - Old Lane Carr;
 - Bacton Wood;
 - The Leaslands;
 - Sparham Grove;
 - North Grove; and
 - Great Wood.
270. Although located further than 500m from the onshore project area, as a result of consultation with Natural England as part of the EPP, the following European designated sites have also been considered further for indirect impacts:
- Paston Great Barn SAC;
 - Norfolk Valley Fens SAC (Booton Common component SSSI);
 - The Broads SAC (Broad Fen, Dilham component SSSI);
 - Holly Farm Meadow, Wendling SSSI; and
 - Whitwell Common SSSI.
271. A full HRA Report has been prepared providing information on the potential for likely significant effects on European and Ramsar sites arising from the project. The information provided here summarises the information presented in the HRA Report submitted as part of the DCO application. Please refer to the HRA Report (document reference 5.3) for full details of potential effects on European and Ramsar sites.

River Wensum SAC and SSSI

272. As part of the embedded mitigation, the River Wensum will be crossed using

trenchless crossing techniques (e.g. HDD), in order to minimise direct impacts upon this site and the habitats/species for which it is designated.

273. The trenchless crossing receptor zone for the River Wensum is located within the floodplain habitat on the south bank of the River Wensum. This habitat was surveyed during the 2017 and 2018 botanical survey and 2017 and 2018 invertebrate survey for presence of qualifying features of the River Wensum SAC (*Ranunculion fluitantis* and *Callitricho-Batrachion* vegetation and Desmoulin's whorl snail). These species were not found during the 2017 and 2018 surveys and are therefore considered to be absent from the floodplain habitat on the south bank of the River Wensum and the River Wensum and floodplain on the north bank. Therefore, potential direct effects upon these qualifying features will not occur at this location.
274. There is a risk of indirect impacts upon the qualifying features of the River Wensum SAC and notified features of the River Wensum SSSI due to works on the land which is functionally connected to the River Wensum at Elsing. The following potential indirect effects have been identified:
- Potential indirect effects on local hydrological conditions within the River Wensum channel due to the introduction of impermeable features (buried cables);
 - Potential indirect effects on water quality arising from accidental release of lubricants, fuels, oils and drilling fluid from construction machinery working in and adjacent to surface watercourses; and
 - Potential increase in the supply of fine sediment to surface watercourses through surface runoff and the erosion of exposed soils.
275. The HRA Report quantified the magnitude of effect on the local hydrological conditions as negligible, although it identified the potential effect arising from release of lubricants, fuels, oils and drilling fluid and release of fine sediment as of low magnitude without mitigation.
276. In addition to the SAC features identified above, barn owls (*Tyto alba*) are a notified feature of the River Wensum SSSI and have been recorded holding territories within the habitat and species study area during the 2017 breeding bird survey. The territory is located outside of the onshore project area (see Appendix 23.4), and as no record of a breeding site was recorded, the potential effects on this species are predicted to be negligible.
277. The potential indirect effects upon the River Wensum SAC and SSSI arising from changes in water regime, risk of pollutant release, dust emissions, and temporary construction lighting during construction are discussed in detail in Chapter 20 Water Resources and Flood Risk, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. No significant impacts arising from changes in water

regime, pollutant release, changes in dust levels and construction lighting have been identified within these chapters.

278. Please refer to the HRA Report (document reference 5.3) for further details of the assessment undertaken with respect to the River Wensum SAC.

Paston Great Barn SAC and SSSI

279. Paston Great Barn SAC and SSSI is located approximately 3km north of the onshore cable route and is designated for its barbastelle bat population. The HRA Report identifies a 5km study area around Paston Great Barn as an appropriate study area for potential impacts upon this site.
280. The project involves hedgerow removal at 16 of the 17 hedgerows of moderate or greater suitability to support commuting / foraging bats within the Paston Great Barn study area identified within the HRA Report. This is predicted to result in the following impacts on the barbastelle colony of Paston Great Barn:
- Direct loss of 198m of hedgerow foraging / commuting habitat across six hedgerows (<0.05% of the available habitat within the Paston Great Barn colony's home range);
 - Fragmentation of approximately 11ha of broadleaved woodland, rank grassland, hedgerows and drainage ditches around Witton used by barbastelles of the Paston Great Barn colony (approximately 0.6% of the Paston Great Barn maternity colony home range); and
 - Indirect effects upon commuting bats arising from construction lighting.
281. Hedgerows will be replanted following works at each location (replanting is described in more detail below). Hedgerows are anticipated to take between 3-7 years to mature, therefore the habitat loss will be temporary and will take place over the medium term (i.e. during the lifespan of one barbastelle). A maximum hedgerow gap of 6m will be retained, if required, for two years to allow for the running track required for cable pulling. All UK bat species are considered able to traverse gaps of 10m or less (JNCC, 2001; BCT, 2012). The duration and scale of this work is anticipated to give rise to an effect of low magnitude.
282. Please refer to the HRA Report (document reference 5.3) for further details of the assessment undertaken with respect to Paston Great Barn SAC.

Norfolk Valley Fens SAC (Booton Common SSSI)

283. Booton Common SSSI, a component SSSI of the Norfolk Valley Fens SAC, is located 600m from the onshore project area. Although outside of the designated sites study area used within this EclA, following consultation as part of the EPP, Natural England requested that potential impacts upon all component SSSIs of the Norfolk Valley

Fens SAC be considered within this assessment. This includes the following component SSSIs:

- Badley Moor;
- Buxton Heath;
- Potter & Scarning Fens, East Dereham; and
- Southrepps Common.

284. The HRA Report considered potential indirect effects upon these five component SSSIs arising from changes to the water supply mechanism which supports these component SSSIs. The wetland water supply mechanism ('WETMECs') accounts (Wheeler and Shaw, 2000) for all sites were reviewed to identify the water supply mechanism for each site. In relation to surface water supply, Booton Common is located 1.5km downstream of the nearest watercourse crossing location, and the remaining component SSSIs are located upstream of the project, and at least 2.8km from the onshore project area. In relation to groundwater supply, the chalk aquifer within the onshore project area is not lower than 15m in any location, which is at least 5m below the deepest excavation employed for the project (up to 10m for trenchless crossings). As such, no pathway of effect has been identified between the project and the component SSSIs of the Norfolk Valley Fens SAC; as such, no change is anticipated upon the Norfolk Valley Fens SAC.
285. The HRA Report also considered potential indirect effects upon Booton Common arising from changes to local air quality from construction traffic.
286. Booton Common is located approximately 1.4km south of the nearest access route for construction vehicles for the proposed project, and is located 600m from the onshore project area. As such, following Institute of Air Quality Management (IAQM) guidance, it is considered to be outside the potential zone of influence of the project in terms of air quality emissions (see Chapter 26 Air Quality).
287. As such, no change is anticipated upon the component SSSIs of the Norfolk Valley Fens SAC.
288. Please refer to the HRA Report (document reference 5.3) for further details of the assessment undertaken with respect to Norfolk Valley Fens SAC.

The Broads SAC (Broad Fen, Dilham SSSI)

289. Although outside of the designated sites study area used within this EclA, following consultation as part of the Norfolk Vanguard EPP, Natural England requested that potential impacts upon The Broads SAC be considered within this assessment.
290. The HRA Report considered potential indirect effects upon The Broads SAC arising from changes to the water supply mechanism for Broad Fen, Dilham (component

SSSI of The Broads SAC) and changes to suitable habitats for otter (a qualifying feature). The 'WETMECs' accounts (Wheeler and Shaw, 2000) for Broad Fen, Dilham was reviewed in order to identify the water supply mechanism for the site.

291. In relation to surface water, as the North Walsham and Dilham Canal would be crossed using trenchless techniques, no effects upon local hydrological conditions are anticipated at this site. The Hundred Stream will be crossed using trenching techniques. As detailed in Chapter 20 Water Resources, the construction techniques at this location will ensure that flow is maintained, and that risk of release of pollutants and sediment is minimised as far as possible. Given the distance between this site and the onshore project area (4.6km in a straight line), the magnitude of these potential effects is considered to be negligible. In relation to groundwater, although there is a possibility that the site is part-groundwater fed, the main supply mechanism for the site appears to be winter floods. As such, no pathway of effect has been identified between the project and the component SSSIs of The Broads SAC; as such, no change is anticipated upon The Broads SAC.
292. Otters are potentially present along the North Walsham and Dilham Canal within the onshore project area. As this site will be avoided through the use of trenchless crossing techniques (e.g. HDD), direct effects to otter habitats have been avoided. No signs of otters were recorded adjacent to the North Walsham and Dilham Canal during the 2017 water vole surveys (which also looked for signs of otter). The Hundred Stream within the onshore project area is not suitable for otters.
293. As such, the greatest magnitude of effect upon The Broads SAC is considered to be negligible.
294. Please refer to the HRA Report (document reference 5.3) for further details of the assessment undertaken with respect to The Broads SAC.

Dillington Carr, Gressenhall SSSI

295. Dillington Carr, Gressenhall SSSI is located approximately 550m downstream of the cable route, on the Wendling Beck watercourse.
296. As part of the embedded mitigation, the Wendling Beck will be crossed using trenchless crossing techniques (e.g. HDD), in order to avoid direct impacts upon this watercourse and the habitats and species it supports.
297. There are potential indirect effects upon the Dillington Carr, Gressenhall SSSI arising from changes in water regime due to the trenchless crossing receptor site works located adjacent to the Wendling Beck upstream of the SSSI proposed for the Wendling Beck. These effects are anticipated to arise due to the risk of pollutant and fine sediment release from the works at the trenchless crossing zone at the Wendling Beck during construction. Given the distance between this site and the

onshore project area, the magnitude of these potential effects is considered to be negligible.

Dereham Rush Meadow SSSI

298. Dereham Rush Meadow is located approximately 400m from the onshore project area. As such no direct impacts upon this site are anticipated.

299. Due to its proximity, the following potential indirect effects may occur:

- Indirect effects upon the habitats and species of the SSSI arising from construction dust emissions;
- Indirect effects upon the habitats and species of the SSSI arising from pollutant release; and
- Indirect effects upon the species of the SSSI arising from temporary construction lighting.

300. These effects are discussed in Chapter 20 Water Resources and Flood Risk, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. No significant impacts arising from changes in dust levels, risk of pollutant release and construction lighting have been identified by these chapters, and therefore no change upon this SSSI is anticipated.

Holly Farm Meadow, Wendling SSSI

301. Holly Farm Meadow, Wendling SSSI is located approximately 900m from the onshore project area. As such no direct or indirect effects arising from dust, noise or lighting emissions upon this site are anticipated.

302. Following consultation with Natural England, the potential water supply mechanism for this site has been identified to determine whether there is any risk of trenching or trenchless techniques giving rise to an effect upon the water supply mechanism. The 'WETMECs' accounts (Wheeler and Shaw, 2000) for Holly Farm Meadow, Wendling was reviewed in order to identify the water supply mechanism for the site. This site is understood to be predominantly groundwater fed, from a shallow intrusion of chalk at this location (Wheeler and Shaw, 2000). A review of BGS borehole data obtained for the nearest trenchless crossing location within the onshore project area to Holly Farm Meadow, Wendling indicates that the chalk is located approximately 17m below ground at level (see Chapter 19 Ground Conditions and Contamination). As trenchless crossing activities at most go down to 10m below ground level, no pathway of effect has been identified between the project and the SSSI; as such, no change is anticipated upon the Holly Farm Meadow, Wendling SSSI.

Whitwell Common SSSI

303. Whitwell Common SSSI is located approximately 1.2km from the onshore project area. As such no direct or indirect effects arising from dust, noise or lighting emissions upon this site are anticipated.
304. Following consultation with Natural England as part of the EPP, the potential water supply mechanism for this site has been identified to determine whether there is any risk of trenching or trenchless techniques giving rise to an effect upon the water supply mechanism. The 'WETMECs' accounts (Wheeler and Shaw, 2000) for Whitwell Common was reviewed in order to identify the water supply mechanism for the site. The site is thought to be predominantly groundwater fed, from a chalk aquifer below drift deposits at this location (Wheeler and Shaw, 2000). A review of BGS borehole data obtained for the nearest trenchless crossing location within the onshore project area to Holly Farm Meadow, Wendling indicates that the chalk is located approximately 24m below ground at level. As trenchless crossing activities at most go down to 10m below ground level, no pathway of effect has been identified between the project and the SSSI; as such, no change is anticipated upon the Whitwell Common SSSI.

Pigney's Wood LNR

305. Pigney's Wood LNR is located adjacent to the onshore cable route. Due to its proximity, the following potential indirect effects may occur:
- Indirect effects upon the habitats and species of the LNR arising from construction dust emissions;
 - Indirect effects upon the habitats and species of the LNR arising from pollutant release; and
 - Indirect effects upon the species of the LNR arising from temporary construction lighting.
306. These effects are discussed in, Chapter 20 Water Resources and Flood Risk, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. No significant impacts arising from changes in dust levels, risk of pollutant release and construction lighting have been identified by these chapters, and therefore no change is anticipated.

Ancient woodlands

307. There are eight ancient woodlands located within 500m of the onshore cable route (see Figure 22.2). A buffer of 15m around all ancient woodland forms part of the embedded mitigation (see Table 22.21). These woodlands are:
- Old Lane Carr (330m south of the cable route);
 - Bacton Wood (180m south of the cable route);
 - The Leaselands (30m west of the cable route);

- Sparham Grove (450m east of the cable route);
 - Old Carr (Dillington) (adjacent to the cable route);
 - North Grove (130m west of the cable route);
 - Great Wood (250m south of the cable route); and
 - Necton Wood (adjacent to the cable route).
308. Following the Forestry Commission's guidance on assessing the impacts of development (Natural England and Forestry Commission, 2018), the following potential effects on ancient woodland from development on adjacent land have been considered:
- Fragmentation and loss of ecological connections with surrounding woodland/ veteran trees and the wider natural landscape;
 - Reduction in the area of other semi-natural habitats adjoining ancient woodland;
 - Increased deposition of dust, particularly from quarries, resulting in physical and/or chemical effects;
 - Impacts on local hydrology through drainage or water table levels changing;
 - Change to the landscape context for ancient woods and veteran trees; and
 - Change to light pollution at night (if development includes street lighting).
309. Indirect effects are not predicted to arise in relation to Old Lane Carr, Bacton Wood, Sparham Grove and North Grove ancient woodlands given their distance from the onshore cable route. In addition, the onshore cable route is not located within an important ecological corridor for any of these woodlands.
310. Potential effects arising from changes in local hydrology, dust emissions, light levels and landscape context are discussed in Chapter 20 Water Resources and Flood Risk, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. A Construction Surface Water and Drainage Plan will form part of the CoCP (DCO Requirement 20(2)(i)) to address the changes to local hydrology and the measures that will be implemented to manage them. An outline CoCP (document reference 8.1) has been prepared and submitted with the DCO application.
311. There will be loss of approximately 40m of species-poor hedgerow with trees in two locations which potentially act as linkages between Necton Wood and Great Wood. Barbastelle bats have been recorded commuting along these features during the 2017 activity survey. These gaps may potentially affect commuting routes between these two ancient woodlands. As this potential fragmentation effect is focussed on two connections only, the impact is considered to be of low magnitude.
312. Construction works associated with the installation of the cable route will not result in the reduction of the area of other semi-natural habitats adjoining ancient woodland.

313. No significant impacts arising from changes in dust levels or in the lighting provision and landscape context have been identified in the assessments reported in Chapter 26 Air Quality or Chapter 29 Landscape and Visual Impact Assessment. As such, a low magnitude of effect is anticipated.

Onshore project substation

314. There are two ancient woodlands within 2km of the onshore project substation location, namely Necton Wood (ancient semi-natural) and Great Wood (ancient semi-natural and ancient replanted) which are located approximately 150m north and approximately 600m east of the onshore project substation respectively. There are no other terrestrial statutory designated sites located within 2km of the onshore project substation.

315. Following the Forestry Commission's guidance on assessing the impacts of development (Natural England and Forestry Commission, 2018), as the onshore project substation location is located within 500m of Necton Wood, the following potential effects on ancient woodland from development on adjacent land have been considered:

- Fragmentation and loss of ecological connections with surrounding woodland/ veteran trees and the wider natural landscape;
- Reduction in the area of other semi-natural habitats adjoining ancient woodland;
- Increased deposition of dust, particularly from quarries, resulting in physical and/or chemical effects;
- Impacts on local hydrology through drainage or water table levels changing;
- Change to the landscape context for ancient woods and veteran trees; and
- Change to light pollution at night (if development includes street lighting).

316. Potential effects arising from changes in local hydrology, dust emissions, light levels, and landscape context are discussed in Chapter 20 Water Resources and Flood Risk, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment.

317. Construction of the onshore substation will result in the permanent loss of approximately 390m of hedgerow (of which 360m is species-poor hedgerow with trees, and 30m species-rich hedgerow with trees), and the further temporary loss of approximately 400m of hedgerow (of which 130m is species-rich hedgerow with trees, and 270m species-rich hedgerow). Approximately 30m of the hedgerow permanently affected is identified as important bat commuting / foraging habitat, while approximately 360m is identified as other habitat supporting commuting / foraging bats; all 400m of the of the hedgerow temporarily affected is identified as important bat commuting / foraging habitat. Construction of the onshore project substation will therefore affect the woodland's ecological connections, although this

is of local scale in the context of the wider hedgerow resource within the region, and therefore is an effect of low magnitude. Fragmentation of habitat networks that have been identified as important for supporting commuting and foraging bats will occur, but not between other ancient woodlands in the vicinity of Necton Wood. The magnitude of this effect is also low.

318. No significant impacts arising from changes in dust levels or in the lighting provision and landscape context have been identified by Chapter 26 Air Quality or Chapter 29 Landscape and Visual Impact Assessment. As such, no change upon this receptor is anticipated.

National Grid substation extension and overhead line modifications

319. There are two ancient woodlands within 2km of the National Grid substation extension, namely Necton Wood (Ancient semi-natural) and Great Wood (ancient semi-natural and ancient replanted). Necton Wood is located approximately 150m east and Great Wood is approximately 1.4km east of the overhead line temporary works area at its closest point (and 1km and 2.2km from the National Grid substation extension respectively). There are no other terrestrial ecology statutory designated sites located within 2km of the National Grid substation extension and overhead line modifications.
320. Following the Forestry Commission's guidance on assessing the impacts of development (Natural England and Forestry Commission, 2018), as the proposed National Grid substation extension works are located within 500m of Necton Wood, the following potential effects on ancient woodland from development on adjacent land have been considered:
- Fragmentation and loss of ecological connections with surrounding woodland/ veteran trees and the wider natural landscape;
 - Reduction in the area of other semi-natural habitats adjoining ancient woodland;
 - Increased deposition of dust, particularly from quarries, resulting in physical and/or chemical effects;
 - Impacts on local hydrology through drainage or water table levels changing;
 - Change to the landscape context for ancient woods and veteran trees; and
 - Change to light pollution at night (if development includes street lighting).
321. Potential effects arising from changes in local hydrology, dust emissions, light levels, and landscape context are discussed in Chapter 20 Water Resources and Flood Risk, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment.
322. The proposed National Grid substation extension works would result in the potential loss of approximately 210m of species-poor hedgerow (100m of which is with trees). Given the higher quality of linking habitat found in other areas surrounding the

proposed substation site, this is not anticipated to be an important linking habitat with Necton Wood. The proposed National Grid substation extension works are therefore not anticipated to affect the woodland's ecological connections. Based on current available data, this is therefore an effect of negligible magnitude.

323. No significant impacts arising from changes in dust levels or in the lighting provision and landscape context have been identified by Chapter 26 Air Quality or Chapter 29 Landscape and Visual Impact Assessment. As such, no change upon this receptor is anticipated.

Road transport network

324. Chapter 26 Air Quality considers the potential impacts of increases in nutrient nitrogen deposition arising from increases in road traffic during the construction phase of the project upon sensitive habitats and species which are qualifying features of SAC, SPA and SSSIs located within 200m of the road transport network. This assessment of the air quality impacts arising from increases in road traffic on the road transport network has been undertaken following the latest Institute of Air Quality Management (IAQM) guidance on assessment of impacts on air quality arising from road traffic emissions (IAQM, 2014). Details are provided in Chapter 26 Air Quality.
325. There are 13 sites located within the construction vehicle emissions study area. Of these, Chapter 26 Air Quality predicts nutrient nitrogen deposition of <1% of the critical load at all sites. As such, no change is anticipated.

Impact without mitigation

326. No change is anticipated on the Norfolk Valley Fens SAC, Dereham Rush Meadow SSSI, Holly Farm Meadow, Wendling SSSI, Whitwell Common SSSI and Pigney's Wood LNR. A temporary effect of negligible magnitude is anticipated on The Broads SAC, Dillington Carr, Gressenhall SSSI as a result of works on the onshore cable route.
327. An effect of low magnitude is anticipated on the River Wensum SAC and SSSI and the Paston Great Barn SAC and SSSI as a result of works on the onshore cable route. An effect of low magnitude is also anticipated on Necton Wood ancient woodland as result of the onshore cable route and the onshore project substation, and an effect of negligible magnitude as a result of the National Grid substation extension.
328. In accordance with Table 22.4 statutory designated sites are of high importance.
329. Without mitigation, the greatest magnitude arising from the onshore project area is at the River Wensum SAC and SSSI, Paston Great Barn SAC and SSSI and Necton Wood ancient woodland. This is low magnitude of effect upon a high importance receptor, resulting in an impact of at worst **moderate adverse** significance.

Mitigation

River Wensum SAC and SSSI

330. The following mitigation measures will be put in place to minimise the risk of sediment or pollutant release into the watercourses which are functionally connected to the River Wensum:

- A scheme and programme for each watercourse crossing, diversion and reinstatement, which will include site specific details regarding sediment management and pollution prevention measures will be developed. This scheme will be submitted to and approved by the relevant planning authority in consultation with Natural England. This commitment is secured through DCO Requirement 25 (Watercourse Crossings). This scheme will include the specific measures listed below;
- Best practice topsoil management practices will be followed. All topsoil will be reinstated and measures will be put in place to reinstate any damage to ground conditions caused by vehicle tracking. All sediment management measures used (e.g. sediment traps) will be removed and disposed of following construction. The practices to be followed will be detailed in a CoCP, the details and content of which will be agreed with the relevant local planning authority in consultation with stakeholders (including the Environment Agency and Natural England) in advance of construction. An outline CoCP has been submitted alongside the DCO application (document reference 8.1);
- A Construction Surface Water and Drainage Plan will be developed as part of the CoCP (DCO Requirement 20(2)(i)) in consultation with the relevant regulators and implemented to minimise water within the cable trench and other working areas and ensure ongoing drainage of surrounding land. This typically includes interceptor drainage ditches being temporarily installed parallel to the trenches and soil storage areas to provide interception of surface water runoff and the use of pumps to remove water from the trenches during duct installation. Drainage would remain in place for the duration of the construction period, including during the cable pulling phase;
- Existing tracks and roadways will be utilised for access where possible. Where temporary accesses are needed, topsoil and surface water management measures will be employed;
- Geotextile, or other suitable material, will be used, where required, to allow the safe storage and movement of vehicles within the area, maintain required drainage, and prevent soil erosion and increased surface runoff;
- A break-out contingency plan will be drafted in case of break-out of drilling fluid during trenchless crossing construction. The details of this plan will be included in the CoCP;

- The working methodology will follow construction industry good practice guidance, as detailed in the Environment Agency's Pollution Prevention Guidance (PPG) notes (including PPG01, PPG05, PPG08 and PPG21)¹⁶, and CIRIA's '*Control of water pollution from construction sites – A guide to good practice*' (2001), such as having spill kits on site at all times, checking equipment regularly to ensure leakages do not occur, and limiting refuelling of construction plant to designated impermeable areas; and
- The project is aiming for a construction scenario whereby works within the River Wensum floodplain (i.e. land north of Penny Spot Beck) are not required, and a trenchless crossing technique (e.g. HDD) at the River Wensum would run beneath this area. However, in advance of a more detailed assessment of ground conditions, this cannot be confirmed at this stage. If land north of Penny Spot Beck within the River Wensum floodplain is used during construction, then works will take place outside of the winter period (October – February inclusive) to avoid the wettest period of the year to minimise the risk of effects on local ground conditions due to vehicle tracking, unless otherwise agreed with Natural England.

331. These mitigation measures will be applied for all works at trenchless crossing zones and are considered suitable for minimising the risk of sediment / pollutant release into watercourses functionally connected with the River Wensum. These measures are good construction working practices and are captured in the OLEMS (document reference 8.7) submitted as part of the DCO application.

Dillington Carr, Gressenhall SSSI

332. The mitigation measures outlined with respect to the River Wensum will be applied for all works at the trenchless crossing zone at Wendling Beck and are considered suitable for minimising the risk of sediment / pollutant release into the Wendling Beck.

Paston Great Barn SAC and SSSI

333. To minimise the potential effect upon commuting and foraging barbastelle bats arising from temporary loss of habitat, the following mitigation measures will be implemented:

- Hedgerow removal will be programmed during winter where possible, to allow bats time to adjust to the change prior to their maternity period. Hedgerows will be removed as close to the onset of works as possible, and works will not commence after nights of poor weather (in case of bad weather roosts being used);

¹⁶ The Environment Agency's PPG were formally withdrawn on 17 December 2015. However, the guidance contains the best reference source for good practice guidance regarding pollution prevention, and in the absence of any formally statutory guidance provides the best framework for managing pollution prevention.

- Replanting will where possible follow in the first winter after construction, with the exception of the 6m gap required for the running track (BCT, 2012). Replanting will follow guidance within the Norfolk hedgerow BAP and will include appropriate species for north-east Norfolk (NBP, 2009), including ground flora planting designed to encourage insect biomass (BCT, 2012). Future hedgerow management to include allowing standard trees to develop to improve quality of the hedgerow as a foraging resource. Hedges will be double-planted with 2m grassland strips on both sides so there is always a leeward side to forage;
 - Subject to landowner permissions, the 16 hedgerows that have been identified as supporting foraging and commuting bats will be left to become overgrown either side of the section to be removed prior to construction. Hedgerows will be allowed to become overgrown within the onshore cable route, therefore at each hedgerow a total of up to 22m will be left to become overgrown in this manner. This measure will be undertaken to improve the quality of the surrounding hedgerow as a resource for commuting and foraging bats (BCT, 2015);
 - A Hedgerow Mitigation Plan will be developed in consultation with Natural England prior to the removal of hedgerows. This mitigation plan will detail the reinstatement approach for hedgerows removed during construction and the monitoring and maintenance requirements following hedgerow planting. This commitment is captured within the OLEMS (document reference 8.7);
 - Pre-construction bat activity surveys at the six hedgerows not yet surveyed will be undertaken to provide full baseline data for these features.
334. In addition to the above mitigation measures, during detailed project design undertaken post-consent, the project will seek to avoid mature trees within hedgerows through the micro-siting of individual cables, in order to retain as many mature trees as possible given the benefits they provide within linear commuting / foraging features (following Boughley *et al.*, 2011).

Ancient woodlands

335. The mitigation measures listed under Paston Great Barn SAC and SSSI will also be applied to the two species-rich hedgerows between Necton Wood and Great Wood.
336. The landscaping proposals described in Chapter 29 Landscape and Visual Impact Assessment have been designed so that any ecological connections severed by construction of the onshore project substation are recreated to ensure ecological corridors connect Necton Wood to other woodlands to the east and south.

Impact following mitigation

337. With the implementation of the mitigations measures, the greatest magnitude of effect upon a statutory designated site is expected to be negligible, resulting in a **minor adverse** residual impact being predicted.

22.7.5.1.3 Scenario 1

Onshore cable route

338. Up to 12km of the 6m wide running track installed for Norfolk Vanguard will be required during the cable pulling works. As the exact location of the running track which will be required is not yet known, it has been assumed as a worst case that the running track may be required in any location along the cable route.

River Wensum SAC and SSSI

339. Although the exact areas of running track required are not known, there is some design flexibility governing the location of jointing pits along the cable route, with a pit required every 500 to 1000m along the cable route. This allows for the option, in some cases, to avoid sensitive locations, particularly around locations of cable 'stop ends'. For example, where possible a jointing pit would not be sited within the floodplain habitat of the River Wensum (as shown in Figure 22.11). Areas of the River Wensum catchment will involve the construction of a 6m wide running track along the route of the running track used for Norfolk Vanguard. This will have a localised, short term effect on runoff rates for up to 16 weeks per annum during the two-year cable pulling phase. This is an effect of negligible magnitude.

Paston Great Barn SAC and SSSI

340. Under a worst case, a running track may be required at the 16 hedgerows located within the Paston Great Barn study area identified within the HRA Report. A maximum hedgerow gap of 6m will be retained, if required, at any one location for the duration of the two-year cable pulling phase to allow for the running track required for cable pulling works. All UK bat species are considered able to traverse gaps of 10m or less (JNCC, 2001; BCT, 2012). As set out in the Draft DCO (document reference 3.1) cable pulling works will take place 7am-7pm and construction lighting adjacent to these hedgerows will not be required outside of these times. The duration and scale of this effect is anticipated to give rise to an effect of negligible magnitude.

Norfolk Valley Fens SAC (Booton Common SSSI)

341. The works proposed under Scenario 1 are well within the envelope set out above for Scenario 2, which predicted no change upon the Booton Common SSSI and the Norfolk Valley Fens SAC. As such, no change is anticipated upon the Booton Common SSSI and the Norfolk Valley Fens SAC under Scenario 1.

The Broads SAC (Broad Fen, Dilham SSSI)

342. As outlined under Scenario 2, the Hundred Stream will not be crossed using trenchless techniques and therefore may require temporary works to allow the running track to cross the watercourse during cable pulling works. The construction techniques at this location will ensure that flow is maintained and that risk of release of pollutants and sediment is minimised as far as possible, as per Scenario 2. Given the distance between this site and the onshore project area, the magnitude of these potential effects is considered to be negligible.

Dillington Carr, Gressenhall SSSI

343. As outlined under the River Wensum SAC and SSSI, although the exact areas of running track required are not known, a jointing pit would not be required immediately adjacent to the Wendling Beck at Dillington, which is upstream of the Dillington Carr, Gressenhall SSSI. Areas of the Wendling Beck catchment will involve the construction of a 6m wide running track along the route of the running track used for Norfolk Vanguard. This will have a localised, short term effect on runoff rates for up to 16 weeks per annum during the two-year cable pulling works. This is an effect of negligible magnitude.

Dereham Rush Meadow SSSI

344. As outlined under the River Wensum SAC and SSSI, although the exact areas of running track required are not known, a jointing pit would not be required within 400m Dereham Rush Meadow SSSI. As a consequence, indirect effects in this location during the 16 week per annum during the two-year cable pulling works are not anticipated to arise, and no change upon Dereham Rush Meadow SSSI is anticipated.

Holly Farm Meadow, Wendling SSSI

345. As cable pulling works will not involve any new excavation works outside of the footprint excavated for Norfolk Vanguard, there is no pathway to affect the groundwater supply to Holly Farm Meadow, Wendling SSSI which is located 900m from the onshore project area. As such, no change upon Holly Farm Meadow, Wendling SSSI is anticipated.

Whitwell Common SSSI

346. As cable pulling works will not involve any new excavation works outside of the footprint excavated for Norfolk Vanguard, there is no pathway to affect the groundwater supply to Whitwell Common SSSI which is located 1.2km from the onshore project area. As such, no change upon Holly Farm Meadow, Wendling SSSI is anticipated.

Pigney's Wood LNR

347. As outlined under the River Wensum SAC and SSSI, although the exact areas of running track required are not known, a jointing pit would not be required within 100m Pigney's Wood LNR. As a consequence, construction works in this location during the 16 week per annum (over two years) cable pulling works is not anticipated to give rise to indirect effects, and no change upon Pigney's Wood LNR is anticipated.

Ancient woodlands

348. The four ancient woodlands identified as potentially subject to indirect effects during the project construction phase under Scenario 2 (The Leaslands, Old Carr (Dillington), Great Wood and Necton Wood) will be potentially subject to the same indirect effects for up to 16 weeks per annum during the two-year cable pulling works. This is a medium term effect of negligible magnitude. Potential effects arising from changes in local hydrology, dust emissions, light levels and landscape context are discussed in Chapter 20 Water Resources and Flood Risk, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. A Construction Surface Water and Drainage Management Plan will form part of the CoCP (DCO Requirement 20(2)(i)) to address the changes to local hydrology and the measures that will be implemented to manage them. An outline CoCP (document reference 8.1) has been prepared and submitted with the DCO application.

Onshore project substation

349. The onshore project substation works under Scenario 1 may give rise to potential indirect effects upon Necton Wood and Great Wood ancient woodlands (as per Scenario 2).

350. Construction of the onshore project substation will result in the permanent loss of approximately 240m of species-rich hedgerow with trees and a further temporary loss of 120m of species-rich hedgerow with trees. All 240m of the hedgerow permanently affected is identified as important bat commuting / foraging habitat. Construction of the onshore project substation will therefore affect the woodland's ecological connections, although this is of local scale in the context of the wider hedgerow resource within the region, and therefore is an effect of low magnitude. Fragmentation of habitat networks that have been identified as important for supporting commuting and foraging bats will occur, but not between other ancient woodlands in the vicinity of Necton Wood. The magnitude of this effect is also considered to be low.

National Grid substation extension

351. Necton Wood is located approximately 700m from the National Grid substation extension under Scenario 1. As such indirect effects are unlikely to arise during the construction phase from dust, noise, temporary lighting and changes in the local

hydrology regime or habitat fragmentation. No change is therefore anticipated upon this receptor.

Impact without mitigation

352. No change is anticipated on the Norfolk Valley Fens SAC, Dereham Rush Meadow SSSI, Holly Farm Meadow, Wendling SSSI, Whitwell Common SSSI or Pigney's Wood LNR. A temporary effect of negligible magnitude is anticipated on the River Wensum SAC and SSSI, Paston Great Barn SAC and SSSI, The Broads SAC, Dillington Carr, Gressenhall SSSI and on ancient woodland, as a result of works along the onshore cable route.
353. An effect of low magnitude is anticipated on Necton Wood ancient woodland as result of the onshore project substation. No change is anticipated in statutory designated sites as a result of the National Grid substation extension.
354. In accordance with Table 22.4 statutory designated sites are of high importance.
355. Without mitigation, the greatest magnitude of effect arising from the onshore project area is at Necton Wood ancient woodland. This is considered to be low on a high importance receptor, resulting in an impact of at worst **moderate adverse** significance.

Mitigation

356. The mitigation set out under Scenario 2 (see section 22.7.5.1.2) for ancient woodlands would be adhered to under Scenario 1.

Impact following mitigation

357. With the implementation of these mitigation measures, the greatest magnitude of effect upon a statutory designated site is expected to be reduced to negligible, resulting in a **minor adverse** residual impact being predicted.

22.7.5.2 Impact 2: Non-statutory designated sites

22.7.5.2.1 Scenario 1 and Scenario 2

Landfall

358. There is one non-statutory designated site within 2km of the landfall, namely The Marram Hills CWS which is located approximately 800m south-east of the landfall. Due to the distance between the Marram Hills CWS and the works at the landfall, there will be no change upon non-statutory designated sites.

Onshore project substation

359. There are five non-statutory designated sites within 2km of the onshore project substation, namely Necton Wood, Great Wood, Fox Covert, Necton Old Common and Land Adjacent to River Wissey. The latter four sites are located over 650m from the onshore project substation, and as such there will be no change upon these non-

statutory designated sites due to the construction of the onshore project substation.

360. The one remaining site, Necton Wood, is located approximately 130m from the onshore project substation. Indirect impacts may potentially arise during the construction phase from dust, noise, temporary lighting and changes in the local hydrology regime. These effects will continue for up to 30 months under both scenarios. No significant impacts have been identified within Chapter 20 Water Resources and Flood Risk, Chapter 25 Noise and Vibration, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. These effects are identified within the relevant chapter to be of low magnitude. These indirect effects are therefore predicted to be of low magnitude.

22.7.5.2.2 Scenario 2

Onshore cable route

361. There are five CWSs and one proposed CWS located within the onshore cable route (see Figure 22.3), specifically:

- Wendling Carr (CWS no. 1013), an area of semi-improved neutral grassland with a thin belt of semi-natural woodland;
- Little Wood CWS (CWS no. 2024), an ancient woodland;
- Paston Way & Knapton Cutting (CWS no. 1175), an ecological corridor with a butterfly reserve and wet woodland;
- Marriott's Way (CWS no. 2176), a green woodland corridor;
- Land south of Dillington Carr (CWS no. 1025), an area of wet woodland; and
- Kerdiston Old Hall Meadows (proposed CWS so it has not been assigned a number at the time of preparing this chapter), proposed for its semi-improved grassland, hedgerow and ditch mosaic.

362. As part of the embedded mitigation measures, all of the CWSs, including the proposed CWS, will be crossed using trenchless crossing techniques (e.g. HDD), in order to minimise direct impacts upon these sites.
363. One of these sites, Wendling Carr CWS, will require a 6m wide running track to be constructed across it. The running track will be approximately 180m long, and will result in the temporary loss of approximately 0.1ha grazed meadow habitat. This represents approximately 2.8% of the total grazed meadow habitat within the CWS. The running track will be micro-sited to avoid sensitive features within the grazed meadow (i.e. mature trees) where possible. The running track will also need to cross the Wendling Beck. The running track will remain in place for the full duration of the onshore construction period in the worst case (i.e. four years in total). These effects are predicted to be of low magnitude given the scale of habitat loss and the temporary nature of the habitat loss.

364. In addition to the six CWS / proposed CWS avoided through the use of trenchless techniques (e.g. HDD), a further seven CWS (namely Necton Wood, Old Carr, Pits near Mill Street, Long Hollands Clump and belt, Pond Wood, Holly's Grove, Vernon Wood), are located adjacent to the trenchless crossing zones along the onshore cable route and therefore indirect effects during the construction phase may be experienced. Indirect impacts may potentially arise during the construction phase from dust, noise, temporary lighting and changes in the local hydrology regime. These effects will occur over two years (duct installation) plus a further 16 weeks in any one area per annum during the two-year cable pulling works. No significant impacts have been identified within Chapter 20 Water Resources and Flood Risk, Chapter 25 Noise and Vibration, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. These effects are identified within the relevant chapter to be of low magnitude. These indirect effects are therefore predicted to be of low magnitude.

National Grid substation extension and overhead line modifications

365. There are four non-statutory designated sites within 2km of the National Grid substation extension and overhead line modifications, namely Necton Wood, Great Wood, Fox Covert and Necton Old Common. The latter three sites are located over 1.4km from the onshore project substation, and as such there will be no change upon these non-statutory designated sites due to the proposed National Grid substation extension and overhead line modifications.

366. Necton Wood is located approximately 150m from the overhead line modifications (and 1km from the National Grid substation extension). Indirect impacts may potentially arise during the construction phase from dust, noise, temporary lighting and changes in the local hydrology regime. These effects will continue for approximately 30 months during construction. No significant impacts have been identified within Chapter 20 Water Resources and Flood Risk, Chapter 25 Noise and Vibration, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. These effects are identified within the relevant chapters to be of low magnitude. These indirect effects to Necton Wood are therefore predicted to be of low magnitude

Impact without mitigation

367. No change is anticipated to non-statutory sites as a result of the landfall works. At Wendling Carr CWS a direct effect of low magnitude is anticipated as result of the installation of the running track.

368. Potential indirect effects of low magnitude are anticipated at 13 non-statutory designated sites identified above as a result of the onshore cable route, onshore project substation and National Grid substation extension.

369. In accordance with Table 22.4 non-statutory designated sites are of medium importance.
370. Without mitigation, the greatest magnitude of effect arising from the onshore project area is low, on a medium importance receptor, resulting in an impact of at worst **minor adverse** significance.

Mitigation

371. Following advice received from NWT during the Norfolk Vanguard EPP, the management proposals for Wendling Car CWS have been taken into account when considering mitigation for Norfolk Boreas. The management proposals for the site state that control of the young (pioneer) species of the broadleaved woodland parcel on the site should be prevented from establishing within the grazed meadow where possible. Methods other than grazing should be used to achieve this. Furthermore, continued monitoring of the site is recommended (NWT, 1996). As such a pre-construction botanical survey of Wendling Carr CWS will be undertaken. Following the botanical survey and subsequent consultation with NWT, manual clearance of any pioneer woodland species establishing within the meadow should be carried out within the grazed meadow prior to construction of the running track. This mitigation approach is set out in the OLEMS (document reference 8.7) provided with the DCO application.
372. Best practice construction mitigation measures will be in place to minimise dust and noise emissions during construction. These measures are described in full in Chapter 25 Noise and Vibration and Chapter 26 Air Quality.

Impact following mitigation

373. If these mitigation measures are applied, the greatest magnitude of effect upon a non-statutory designated site is expected to be reduced to negligible, resulting in a **minor adverse** residual impact.

22.7.5.2.3 Scenario 1

Onshore cable route

374. Under Scenario 1, the 6m wide running track will be reinstated within the Wendling Beck CWS and used for up to 16 weeks in any one area per annum during the two-year cable pulling works. The potential temporary effects of reinstating this running track will be as per Scenario 2 (i.e. of low magnitude).
375. As the exact location of the running track which needs to be reinstated is not known at this stage, there is potential for indirect effects on the 13 CWS located adjacent to the onshore cable route to arise during 16 weeks in any one area per annum during the two-year cable pulling works. Indirect impacts may potentially arise during the construction phase from dust, noise, temporary lighting and changes in the local

hydrology regime. No significant impacts have been identified within Chapter 20 Water Resources and Flood Risk, Chapter 25 Noise and Vibration, Chapter 26 Air Quality and Chapter 29 Landscape and Visual Impact Assessment. These effects are medium-term and predicted to be of low magnitude.

National Grid substation extension

376. Necton Wood is located approximately 700m from the National Grid substation extension under Scenario 1. As such, unlike Scenario 2, indirect effects are unlikely to arise during the construction phase from dust, noise, temporary lighting and changes in the local hydrology regime. No change is therefore anticipated upon this receptor.

Impact without mitigation

377. No change is anticipated to non-statutory sites as a result of the landfall works or the works at the National Grid substation extension. As per Scenario 2 effects of low magnitude are anticipated as a result of works on the onshore cable and at the onshore project substation.

378. In accordance with Table 22.4 non-statutory designated sites are of medium importance.

379. Without mitigation, the greatest magnitude of effect is low on a medium importance receptor, resulting in an impact of at worst **minor adverse** significance.

Mitigation

380. The mitigation set out under Scenario 2 (see section 22.7.5.2.2) for the Wendling Carr CWS and the requirements for best practice construction mitigation measures would be adhered to under Scenario 1.

Impact following mitigation

381. If these mitigation measures are applied, the greatest magnitude of effect upon a non-statutory designated site is expected to be reduced to negligible, resulting in a **minor adverse** residual impact.

22.7.5.3 Impact 3: Arable land

22.7.5.3.1 Scenario 1 and Scenario 2

Landfall

382. The landfall works will lead to a temporary loss of approximately 0.6ha of arable land for the duration of the construction phase (20 weeks for duct installation followed by up to 16 weeks for cable pulling over approximately four years). Cereal field margins, a UKHPI and Norfolk LBAP habitat, were not identified in any of the arable habitats found at the landfall. Arable land is typically of low ecological value due to the homogeneity of the habitat as well as farming practices and the presence of insecticides and herbicides within the crops. As such this habitat is of negligible

importance. Given the extent of arable land within the surrounding area, the magnitude of effect is predicted to be negligible.

22.7.5.3.2 Scenario 2

Onshore cable route

383. The construction of the onshore cable route will result in a temporary loss of approximately 333ha of arable land during the cable duct installation element of the construction phase (approximately two years) and up to approximately 7ha for 16 weeks in any one area per annum during the two year cable pulling works element of the construction phase.
384. Cereal field margins were identified in a number of areas along the cable route during the 2017 and 2018 Extended Phase 1 Habitat Survey. As a UKHPI, this habitat type is of high importance. There is likely to be a negligible temporary loss of cereal field margin habitat. Loss of this habitat will not coincide with arable cropping on the adjacent arable land, therefore the role of these habitats as conservation headlands will not be affected during construction. The area of cereal field margin lost (a small fraction of total arable land) is of a small scale in the context of the 750ha of field margins within Norfolk. As such, the magnitude of effect is considered to be negligible.

Onshore project substation

385. The onshore project substation works will lead to a temporary loss of approximately 9.5ha of arable land for the duration of the construction phase (approximately 30 months). Cereal field margins were not identified in any of the arable habitats found at the onshore project substation, as such this habitat is of negligible importance. Given the extent of arable land in the surrounding area, the magnitude of effect is considered to be negligible.

National Grid substation extension and overhead line modifications

386. Work at the National Grid substation extension and overhead line modifications will result in a temporary loss of approximately 27.4ha of arable land for the duration of the construction phase (approximately 30 months). Cereal field margins were not identified in any of the arable habitats found at the National Grid extension zone, as such this habitat is of negligible importance. Given the extent of arable land in the surrounding area, the magnitude of effect is considered to be negligible.

Impact without mitigation

387. Works at the landfall, onshore project substation and National Grid substation extension will result in temporary loss of arable land of negligible magnitude on a habitat of negligible importance.

388. Works on the onshore cable route will result in a temporary loss of arable land of negligible magnitude. This includes loss of cereal field margin (a small fraction of total arable land), which habitat as a UKHPI is of high importance.
389. Without mitigation, the greatest magnitude arising from the project is negligible on a high importance receptor, resulting in an impact of at worst **minor adverse** significance (upon cereal field margins).

Mitigation

390. The locations of all cereal field margins within the onshore project area identified during the 2017 and 2018 Extended Phase 1 Habitat Surveys or during post-consent surveys of the unsurveyed areas will be recorded, and these habitats should be reinstated post-construction.

Impact following mitigation

391. With these mitigation measures in place, the greatest magnitude of effect upon arable land would remain negligible, which is expected to result in a **minor adverse** residual impact (upon cereal field margins).

22.7.5.3.3 Scenario 1

Onshore cable route

392. Up to 12km of 6m running track will be required to be reinstated during the cable pulling works. As the exact location of the running track which will be required is not yet known, it has been assumed that the running track may be required in any location along the cable route.
393. The onshore cable route works will result in a temporary loss of approximately 7ha for 16 weeks per annum during the two year cable pulling element of the construction phase.
394. As for Scenario 2, the area of cereal field margin (a small fraction of total arable land) lost is of a small scale in the context of the 750ha of field margins within Norfolk. As such, the magnitude of effect is negligible.

Onshore project substation

395. The onshore project substation works will lead to at most a temporary loss of approximately 9.5ha of arable land for the duration of the construction phase (approximately 30 months). Cereal field margins are a UKHPI and Norfolk LBAP habitat. This habitat was not identified in any of the arable habitats found at the onshore project substation. As such this habitat is of negligible importance. Given the extent of arable land in the surrounding area, the magnitude of effect is negligible.

National Grid substation extension

396. Work at the National Grid substation extension will result in a temporary loss of approximately 9.5ha of arable land for the duration of the construction phase (approximately 30 months). Cereal field margins are a UKHPI and Norfolk LBAP habitat. This habitat was not identified in any of the arable habitats found at the National Grid extension zone. As such this habitat is of negligible importance. Given the extent of arable land in the surrounding area, the magnitude of effect is considered to be negligible.

Impact without mitigation

397. As for Scenario 2 works at the landfall, onshore project substation and National Grid substation extension will result in temporary loss of arable land of negligible magnitude on a habitat of negligible importance.

398. Works on the onshore cable route will result in temporary loss of arable land of negligible magnitude. This includes loss of cereal field margin (a small fraction of total arable land), which habitat as a UKHPI is of high importance.

399. Without mitigation, the greatest magnitude of effect arising from the project is negligible on a high importance receptor, resulting in an impact of at worst **minor adverse** significance (upon cereal field margins).

Mitigation

400. The mitigation set out under Scenario 2 (see section 22.7.5.3.2) for cereal field margins would also be adhered to under Scenario 1.

Impact following mitigation

401. With these mitigation measures in place, the greatest magnitude of effect upon arable land would remain negligible, which is expected to result in a **minor adverse** residual impact (upon cereal field margins).

22.7.5.4 Impact 4: Woodland, trees and scrub

22.7.5.4.1 Scenario 1 and Scenario 2

Landfall

402. The landfall works are located outside of any woodland habitat and as such no change upon these habitats is anticipated as a result of the landfall works under both scenarios.

Onshore project substation

403. There are no woodland habitats located within the onshore project substation and as such no change upon these habitats is anticipated as a result of the project under both scenarios. Potential effects upon the Necton Wood Ancient Woodland, located within 150m of onshore project substation, are considered in section 22.7.5.1.

22.7.5.4.2 Scenario 2

Onshore cable route

404. As part of the embedded mitigation, the avoidance of ancient woodland and woodland parcels where possible was a key design principle applied during the site selection process. This includes the use of trenchless crossing techniques (e.g. HDD) at any location where mixed lowland deciduous woodland is present and which cannot be avoided (for example, at Little Wood Ancient Woodland). Site selection also followed the principle that no works will take place within 15m of any woodland. Adherence to these principles means that no change upon woodland is anticipated as a result of the project.
405. Isolated mature trees located within the onshore cable route will need to be removed during the construction phase. Two veteran trees are located within the onshore cable route. TN288 at the River Bure will be avoided using trenchless techniques. The remaining tree at TN168 (see Figure 22.5) will be avoided through micrositing of the route as part of the project embedded mitigation. Loss of other mature trees encountered along the route represents an effect of medium magnitude on a receptor with negligible importance. Trees located within hedgerows are discussed in section 22.7.5.5.

National Grid substation extension and overhead line modifications

406. There are woodland strips along the A47 located within the overhead line temporary working area. Temporary works at this location will not involve the removal of this woodland, although pruning works may be required. Pruning works are anticipated to have a negligible effect upon trees of the woodland in this location. As a consequence, a negligible effect is anticipated upon this habitat.

Impact without mitigation

407. No change is anticipated on woodland habitats or trees as a result of works at the landfall, onshore project substation or the National Grid substation extension.
408. The onshore cable route and overhead line modifications could result in a potential pruning or loss of mature trees which represents an effect of medium magnitude on a receptor with negligible importance.
409. Without mitigation, the greatest effect arising on the project is of medium magnitude on a receptor with negligible importance (mature trees), resulting in an impact of at worst **negligible** significance.

Mitigation

410. A pre-construction walkover survey will be undertaken by a suitably qualified Arboriculturalist. This survey will define specific mitigation measures to protect trees situated adjacent to the working width, including defining root protection

areas. The arboricultural report will be submitted to and agreed with the local authority prior to the commencement of any construction works. In addition, the following mitigation measures will also be undertaken:

- The roots of retained trees along the edge of the working width will be protected from soil compaction by using appropriate measures (e.g. fencing off sensitive areas, use of ground protection matting, etc.) within the trees' Root Protection Areas (the extent of which will be calculated using guidance from BS5837: 2012);
- Facilitation pruning may be recommended where tree crowns are at risk from impact by machinery or high sided vehicles;
- Where possible, removal of vegetation will be timed to avoid the bird breeding season (March to October inclusive); and
- If bat roosts are found in the trees then the measures set out in section 22.7.5.10 (bat mitigation) will be followed.

411. This mitigation is set out in the OLEMS (document reference 8.7) submitted as part of the DCO application.

Impact following mitigation

412. Following mitigation, the magnitude of effect would be remain medium upon a receptor of negligible importance, ensuring a residual impact of **negligible** significance (upon mature trees) remains.

22.7.5.4.3 Scenario 1

Onshore cable route

413. Under Scenario 1, no woodland habitat would be removed to facilitate the cable pulling works. As such no change is anticipated upon this receptor.

National Grid substation extension and overhead line modifications

414. There are no woodland habitats located within the National Grid substation extension area under Scenario 1. As a consequence, no change is anticipated upon this habitat under this scenario.

Impact without mitigation

415. As this habitat would not be removed, or is not located within the onshore project area under Scenario 1, **no impact** is anticipated upon this receptor.

Mitigation

416. No mitigation is proposed under Scenario 1.

22.7.5.5 Impact 5: Hedgerows

22.7.5.5.1 Scenario 1 and Scenario 2

Landfall

417. There are no hedgerows located within the landfall and as such no change upon these habitats is anticipated under either scenario.

22.7.5.5.2 Scenario 2

Onshore cable route

418. The construction of the onshore cable route will result in a temporary loss of approximately 2.5km of hedgerow habitat across 196 hedgerows (of which up to 1.8km may be species-rich¹⁷ (141 hedgerows)) for two years during the duct installation element of the construction phase. Of these hedgerows, approximately 230m across 39 hedgerows will also be lost for an additional two years during the cable pulling element of the construction phase. As part of the project's embedded mitigation, the maximum size of the hedgerow gap created is 13m for perpendicular crossings. As a viable area of UKHPI and Norfolk BAP hedgerow habitat, the local resource is of high importance. The scale of the habitat loss is of low magnitude as although individual gaps are small, 2.5km of hedgerow represents a notable area of habitat at a district level.

Onshore project substation

419. Construction of the onshore substation will result in the permanent loss of approximately 390m of hedgerow (of which 360m is species-poor hedgerow with trees, and 30m species-rich hedgerow with trees), and the further temporary loss of approximately 400m of hedgerow (of which 130m is species-rich hedgerow with trees, and 270m species-rich hedgerow). As a viable area of UKHPI and Norfolk BAP hedgerow habitat, the local resource is of high importance. The scale of the habitat loss is of low magnitude given the context of surrounding hedgerows.

National Grid substation extension and overhead line modifications

420. The National Grid substation extension will result in a potential temporary loss of approximately 210m of species-poor hedgerow (100m of which is with trees) for the duration of the construction phase (approximately 30 months). As a viable area of UKHPI and Norfolk BAP hedgerow habitat, the local resource is of high importance. The scale of the habitat loss is of low magnitude given the context of surrounding hedgerows.

¹⁷ 1.8km assumes, following a precautionary approach, that all hedgerows identified using the Norfolk Living Map and aerial photography are species-rich.

Impact without mitigation

421. Works on the onshore cable route, onshore project substation and the National Grid substation extension are anticipated to have an effect of low magnitude on hedgerows which are considered of high importance. No change upon hedgerows is anticipated at the landfall.
422. Without mitigation, the greatest effect arising from the project is of low magnitude on a high importance receptor, resulting in an impact of at worst **moderate adverse** significance.

Mitigation

423. To minimise the potential effect upon hedgerows arising from temporary loss of habitat, the following mitigation measures will be implemented. Note, this mitigation applies to hedgerows that will be removed – additional mitigation applies to those hedgerows which have been identified as important for the species which they support (for example, see section 22.7.5.1):
- Replanting will where possible follow in the first winter after construction of all except the 6m gap required for the running track. Replanting will follow guidance within the Norfolk Hedgerow BAP and will include appropriate species for north-east Norfolk (NBP, 2009), including ground flora planting designed to encourage insect biomass (BCT, 2012). Future hedgerow management to include allowing standard trees to develop to improve quality of the hedgerow as a foraging resource. Hedges will be double-planted with 2m grassland strips on both sides so there is always a leeward side to forage;
 - A Hedgerow Mitigation Plan will be developed in consultation with Natural England prior to the removal of hedgerows. This mitigation plan will detail the reinstatement approach for hedgerows removed during construction and the monitoring and maintenance requirements following hedgerow planting. This commitment is captured within the OLEMS (document reference 8.7).
424. In addition to the above mitigation measures, during detailed project design, the project will seek to avoid mature trees within hedgerows through the micro-siting of individual cables, in order to retain as many mature trees as possible.
425. The landscaping proposals described in Chapter 29 Landscape and Visual Impact Assessment have been designed to ensure that new planting is created to compensate for the permanent loss of species-rich hedgerow at the onshore project substation. Approximately 230m of new hedgerow is proposed along the western margin of onshore project substation, and a further approximately 1km of existing hedgerow will be enhanced with adjacent woodland and species-rich grassland planting. Please see Chapter 29 Landscape and Visual Impact Assessment for full details of the proposed landscape mitigation planting.

Impact following mitigation

426. These mitigation measures will ensure that the habitat which is temporarily lost for between two and four years (plus the length of time for reinstatement hedgerows to mature) is replaced by improved hedgerow habitat which meets the criteria set out in the Norfolk Hedgerow BAP (NBP, 2009). Therefore, in the long-term, there will be a beneficial effect upon this receptor. However, given the duration of these temporary effects before reaching this point (up to 11 years for restored hedgerows to be greater value than that lost during construction), the magnitude of effect will remain low on a high importance receptor, resulting in a residual impact of **moderate adverse** significance.

22.7.5.5.3 *Scenario 1*

Onshore cable route

427. Under Scenario 1, all existing hedgerow will have been removed by Norfolk Vanguard. As a consequence there will be no change on this receptor during the cable pulling works.

Onshore project substation

428. Construction of the onshore substation will result in the permanent loss of approximately 240m of species-rich hedgerow with trees, and the further temporary loss of approximately 120m of species-rich hedgerow with trees. As a viable area of UKHPI and Norfolk BAP hedgerow habitat, the local resource is of high importance. The scale of the habitat loss is of low magnitude given the context of surrounding hedgerows.

National Grid substation extension

429. The National Grid substation extension will result in a potential permanent loss of approximately 140m of species-poor defunct hedgerow. As a viable area of UKHPI and Norfolk BAP hedgerow habitat, the local resource is of high importance. The scale of the habitat loss is of low magnitude given the context of surrounding hedgerows.

Impact without mitigation

430. No change to hedgerows is anticipated for the cable pulling or landfall works. However, works at the onshore project substation and the National Grid substation extension are anticipated to have an effect of low magnitude on hedgerows which are considered of high importance.
431. Without mitigation, the greatest effect arising from the project is of low magnitude on a high importance receptor, resulting in an impact of at worst **moderate adverse** significance.

Mitigation

432. The mitigation set out under Scenario 2 (see section 22.7.5.4.2) for hedgerows would be adhered to under Scenario 1.

Impact following mitigation

433. These mitigation measures will ensure that the habitat which is permanently lost at the onshore project substation and National Grid substation extension is replaced by new hedgerow habitat which meets the criteria set out in the Norfolk Hedgerow BAP (NBP, 2009). The provision of improved local hedgerow habitat (as detailed in Chapter 29 Landscape and Visual Impact Assessment) ensures that the adverse effect of losing habitat at these locations is of negligible magnitude, resulting in a residual impact of **minor adverse** significance.

22.7.5.6 Impact 6: Grassland

22.7.5.6.1 Scenario 1 and Scenario 2

Landfall

434. The onshore elements of the landfall works are located outside of any grassland habitat and as such no change upon these habitats is anticipated as a result of the project under either scenario.

Onshore project substation

435. There are no grassland habitats located within the onshore project substation and as such no change upon these habitats is anticipated as a result of the project under either scenario.

National Grid substation extension and overhead line modifications

436. There are no grassland habitats located within the National Grid substation extension and as such no change upon these habitats is anticipated as a result of the project under either scenario.

22.7.5.6.2 Scenario 2

Onshore cable route

437. The onshore cable route works will result in a temporary loss of approximately 1ha of coastal floodplain grazing marsh UKHPI and Norfolk LBAP habitat for trenchless crossing works within the River Wensum floodplain and adjacent to the North Walsham and Dilham Canal for the duration of the trenchless crossing works element of the construction phase (approximately eight weeks) and for a further 16 weeks in any one area per annum during the two year cable pulling element of the construction phase. The onshore cable route works will lead at most to a temporary loss of 3.3ha of semi-improved grassland and 12.8ha of marshy grassland. All habitats will be reinstated upon completion of the project. Reinstatement of these grasslands will be by natural regeneration following demobilisation.

438. Potential effects upon the species which utilise this habitat are considered in Chapter 23 Onshore Ornithology.
439. As a UKHPI, coastal floodplain grazing marsh is of high importance. The area of coastal floodplain grazing marsh lost is of a small scale in the context of the 29,500ha of this habitat within Norfolk. As the potential effects are of short duration and reinstatement will happen rapidly, the magnitude of effect is negligible.

Impact without mitigation

440. A potential effect on grassland is only anticipated as part of the onshore cable route, where a temporary loss of semi-improved and marshy grassland of negligible magnitude is anticipated on a receptor of high importance, resulting in an impact of **minor adverse** significance.

Mitigation

441. All grassland habitats would be reinstated following the completion of works, including coastal floodplain grazing marsh. Reinstatement of these grasslands will be by natural regeneration following demobilisation.
442. The mitigation measures set out with respect to the River Wensum SAC and SSSI will be adhered to during all works undertaken within the UKHPI coastal and floodplain grazing marsh. These construction working practices are captured in the OLEMS (document reference 8.7) submitted as part of the DCO application.

Impact following mitigation

443. Following implementation of these mitigation measures, the magnitude of these effects will reduce although will remain of negligible magnitude as this receptor will still be subject to short-term disturbance during construction prior to reinstatement. As such, a residual impact of **minor adverse** significance would remain.

22.7.5.6.3 *Scenario 1*

Onshore cable route

444. Under Scenario 1, all existing grasslands which are located in areas where the running track would need to be reinstalled for the project will have been removed for Norfolk Vanguard. As a consequence there will be **no change** on this receptor during the cable pulling works.

Impact without mitigation

445. Under Scenario 1, this habitat would not be affected during the construction phase, resulting in **no impact** upon this receptor.

Mitigation

446. No mitigation is proposed under Scenario 1.

22.7.5.7 Impact 7: Coastal habitats

22.7.5.7.1 Scenario 1 and Scenario 2

Landfall

447. The onshore elements of the landfall works are located outside of any coastal habitat and as such no change upon these habitats is anticipated as a result of the project.

All other infrastructure

448. There are no coastal habitats located within or adjacent to any other element of the onshore project area, and as such no change upon these habitats is anticipated to arise from these elements of the construction phase.

Impact without mitigation

449. As these habitats are not present within the onshore project area, **no impact** upon this receptor is anticipated under either scenario.

Mitigation

450. No mitigation is required.

22.7.5.8 Impact 8: Watercourses and Ponds

22.7.5.8.1 Scenario 1 and Scenario 2

Landfall

451. The onshore elements of the landfall works are located outside of any rivers or ponds and as such no change upon these habitats is anticipated as a result of the project under either scenario.

Onshore project substation

452. There are no rivers or ponds located within the onshore project substation and as such no change upon these habitats is anticipated as a result of the project under either scenario.

National Grid substation extension

453. The National Grid substation extension will result in a temporary loss of one pond (TF8810-8-A) (maximum) during the construction phase (approximately 30 months). The project design includes the reinstatement of all ponds temporarily lost during construction, where possible. Ponds are a UKHPI and a Norfolk LBAP habitat, and as such are of high importance. Given the extent of these habitats within the wider environment, and the reversible nature of these effects, this impact is anticipated to be of low magnitude. The potential for these habitats to support protected or notable species is considered in section 22.7.5.13.

22.7.5.8.2 Scenario 2

Onshore cable route

454. The onshore cable route will result in a temporary loss of 16 ponds during the cable ducting element of the construction phase (approximately two years) and potentially for a further 16 weeks in any one area per annum during the two year cable pulling element of the construction phase. Two further ponds, also located within the onshore project area, will be avoided using trenchless crossing techniques. All lost ponds will be reinstated as part of the project embedded mitigation. Ponds are a UKHPI and a Norfolk LBAP habitat, and as such are of high importance. Given the extent of these habitats within the wider environment, this effect is anticipated to be of low magnitude. The potential for these habitats to support protected or notable species is considered in section 22.7.5.13.
455. Five main rivers will be crossed by the onshore cable route, one of which – the Wendling Beck – is crossed twice (i.e. six main river crossings in total). These watercourses will be crossed using trenchless crossing techniques (e.g. HDD) as part of embedded mitigation, and as such there will be no direct effects upon these receptors. A total of 27 other watercourse crossings will be made using trenched techniques during the construction phase. Potential indirect effects arising from all watercourse crossings are considered in Chapter 20 Water Resources and Flood Risk. Rivers are a UKHPI and a Norfolk LBAP habitat, and as such are of high importance. Given the extent of these habitats within the wider environment, this effect is anticipated to be of low magnitude.

Impact without mitigation

456. No change to watercourses or ponds are anticipated during the landfall or onshore project substation works. For the National Grid substation extension a temporary loss of a low magnitude of effect is anticipated on one pond, a receptor of high importance. On the onshore cable route effects of low magnitude are anticipated on ponds and watercourses, both considered receptors of high importance.
457. Without mitigation, the greatest magnitude of effect arising from the project is of low magnitude on a high importance receptor, and results in an impact of at worst **moderate adverse** significance.

Mitigation

458. All pond habitats lost during construction will be reinstated as far as possible following the completion of works. All pond restoration will follow the guidelines set out in the Norfolk Ponds BAP (NBP, 2010). The project is also retaining the option to recreate a greater number of ponds than is lost during project construction (five) or restore new ponds outside the onshore project area. This will be agreed during the great crested newt mitigation licencing process post-consent (see section 22.7.5.13

for further details). Full details of this approach to mitigation is set out in section 22.7.5.13.

459. These measures are captured in the OLEMS (document reference 8.7) which has been submitted with the DCO application.
460. Mitigation measures to reduce the potential direct and indirect effects on watercourses during watercourse crossing activities are described in detail in Chapter 20 Water Resources and Flood Risk. These include construction practices to mitigate the potential effects of sediment and pollutant release to watercourses during construction. These measures will be secured via a CoCP (DCO Requirement 20), an outline version of which has been submitted as part of the DCO application (document reference 8.1).

Impact following mitigation

461. Following implementation of these mitigation measures, the long-term habitat improvement following the ponds restoration, means the magnitude of effect will be negligible, giving an expected residual impact of **minor adverse** significance.

22.7.5.8.3 Scenario 1

Onshore cable route

462. Under Scenario 1, all existing ponds will have been removed by Norfolk Vanguard. As a consequence there will be no change on this receptor during the cable pulling works.
463. During cable pulling works up to 12km of the 6m running track will be reinstated. As the exact location of the running track which will be required is not yet known, it has been assumed that the running track may require temporary watercourse crossings. Potential indirect effects arising from all watercourse crossings are considered in Chapter 20 Water Resources and Flood Risk. Rivers are a UKHPI and a Norfolk LBAP habitat, and as such are of high importance. Given the extent of these habitats within the wider environment, this effect is anticipated to be of low magnitude.

Impact without mitigation

464. As for Scenario 2, no change to watercourses or ponds are anticipated during the landfall or onshore project substation works. For the National Grid substation extension a temporary loss of low magnitude is anticipated on one pond, a receptor of high importance. On the onshore cable route effects of low magnitude are anticipated on watercourses, considered receptors of high importance.
465. Without mitigation, the greatest magnitude of effect arising the project is low on a high importance receptor, and results in an impact of at worst **moderate adverse** significance.

Mitigation

466. The mitigation set out under Scenario 2 (see section 22.7.5.8.2) for watercourses and ponds would be adhered to under Scenario 1.

Impact following mitigation

467. Following implementation of these mitigation measures, the long-term habitat improvement following the ponds restoration, means the magnitude will be reduced to negligible, giving an expected residual impact of **minor adverse** significance.

22.7.5.9 Impact 9: Badgers

22.7.5.9.1 Scenario 1 and Scenario 2

Landfall

468. No badger setts or field signs of badgers were recorded within 50m of the landfall, therefore no change is predicted upon badgers at the landfall as a result of the project under either scenario.

Onshore project substation

469. No badger setts or field sign of badgers were recorded within 50m of the onshore project substation, therefore no change upon badgers at the onshore project substation works is anticipated as a result of the project under either scenario.

National Grid substation extension and overhead line modifications

470. No badger setts or field sign of badgers were recorded within 50m of the National Grid substation extension, therefore no change is predicted upon badgers at the proposed National Grid substation extension as a result of the project under either scenario.

22.7.5.9.2 Scenario 2

Onshore cable route

471. [Redacted text block]

472. [Redacted text block]

473. The construction of the onshore cable route would also represent the temporary loss of a negligible area (approximately 13m) of arable margin and hedgerow foraging

■■■■ This is sub-optimal foraging habitat, and in the context of the available foraging resource surrounding the identified setts this is small in scale. Furthermore, creation of the running track will result in potential fragmentation of badger territories, over two years. Given the extensive alternative foraging habitat available within the habitat and species study area and that the onshore cable route does not separate two main setts at any location within the habitat and species study area, this is considered to have a negligible effect upon local badger territories.

474. Overall the magnitude of effect is medium as the local badger population would be directly affected given the long-term nature of the effect on the local badger population in three locations.

Unsurveyed areas

475. Approximately 35% of the habitat and species study area has not been surveyed for field signs of badgers. In these areas, following a precautionary approach it has been assumed that active main setts may be present within or adjacent to the onshore cable route, and which may be destroyed during the project construction phase. Should this occur, this would represent an effect of medium magnitude.

Impact without mitigation

476. A potential effect on badgers is only anticipated as part of the onshore cable route works where an overall effect of medium magnitude is anticipated on a receptor of low importance, resulting in an impact of at worst **minor adverse** significance.

Unsurveyed areas

477. Without mitigation, the greatest magnitude of effect arising from the unsurveyed areas is medium on a low importance receptor, resulting in an impact of at worst **minor adverse** significance.

Mitigation

478. All active setts (of any category) found within the onshore project area would need to be closed and destroyed. This would require the preparation and submission of a licence application to Natural England and would follow their Standing Advice (Natural England, 2015a) on sett closure and destruction. An artificial sett would also be required for all main setts that are to be closed and destroyed.

479. The exact details of sett closure would be agreed in advance with Natural England through the licensing process, and would follow Natural England's Standing Advice (Natural England, 2015a) on sett closure and destruction.
480. In order to minimise the potential disturbance effects on badger during the construction phase, mitigation measures will be agreed in advance of any works within 30m of an active badger sett (following Natural England's Standing Advice on the impact of development on badgers (Natural England, 2015a; English Nature, 2002)), which will include consideration of habitat manipulation, buffer zones for different construction activities within 30m of known badger setts, timing of construction works and construction lighting.
481. Adherence to mitigation measures agreed in advance with Natural England would be considered sufficient that a licence to disturb a badger sett will not be required.
482. A pre-construction badger survey of all active badger setts found within the habitat and species study area will be undertaken in advance of construction to ensure that the location of setts has not changed. If setts have now moved closer to the onshore project area, a suitably qualified ecologist would assess whether a disturbance licence may be required (or alternatively works under a badger class licence). The details of this licence would need to be agreed with Natural England in advance of construction.
483. All hedgerow habitat removed will be reinstated in line with the Norfolk Hedgerow BAP (NBP, 2009).
484. These measures are captured in the OLEMS (document reference 8.7).

Unsurveyed areas

485. For all unsurveyed areas of the onshore cable route, a full badger survey will be undertaken to search for field signs of badgers within the habitat and species study area.
486. If active setts (any category) are found within the onshore project area, the mitigation set out above for sett closure would be adhered to.

Impact following mitigation

487. Following implementation of these mitigation measures, the risk of disturbance to badger setts is reduced to an effect of negligible magnitude. Potential medium-term, localised habitat fragmentation of low magnitude will remain, which is likely to result in a residual impact of at worst **minor adverse** significance.

Unsurveyed areas

488. As above, following implementation of these mitigation measures, the risk of disturbance to badger setts or killing or injuring badgers is reduced to a negligible

magnitude. Potential medium-term, localised habitat fragmentation of low magnitude will remain, giving an expected residual impact of at worst **minor adverse** significance.

22.7.5.9.3 Scenario 1

Onshore cable route

489. All setts located within the onshore cable route will have been closed by Norfolk Vanguard.
490. The 12 active setts (five main setts and a seven subsidiary and outlier setts) located outside of the onshore project area but within 30m of the onshore cable route will potentially be subject to temporary disturbance arising from vehicle movements and spoil storage within 30m of these active setts for 16 weeks per annum during the cable pulling element of the construction phase.
491. The use of the running track would also represent the temporary fragmentation of badger territories, over up to two years. Given the extensive alternative foraging habitat available within the habitat and species study area and that the onshore cable route does not separate two main setts at any location within the habitat and species study area, this is considered to have a negligible effect upon local badger territories.
492. Overall the magnitude of effect is low as the local badger population would be indirectly affected in the medium term.

Impact without mitigation

493. A potential effect on badgers is only anticipated as [REDACTED] works where an overall effect of low magnitude is anticipated on a receptor of low importance, resulting in an impact of at worst **minor adverse** significance.

Mitigation

494. The mitigation set out under Scenario 2 (see section 22.7.5.9.2) would be adhered to under Scenario 1.

Impact following mitigation

495. Following mitigation, the risk of disturbance to badger setts is reduced to an effect of negligible magnitude and potential habitat fragmentation will remain of negligible magnitude. The greatest effect arising from the project is negligible magnitude on a low importance receptor, resulting in a residual impact of at worst **negligible** significance.

22.7.5.10 Impact 10: Bats

22.7.5.10.1 Scenario 1 and Scenario 2

Landfall

496. Barbastelle bats of the Paston Great Barn maternity colony are known to use the north Norfolk coastline for foraging and commuting purposes. The key areas of the coastline are from Mundesley to Walcott (NBSG, 2017). These areas are located approximately 5km from the landfall. There are no other suitable commuting / foraging or potential bat roost features located within the landfall. In light of this, no change upon commuting or foraging bats is anticipated.

22.7.5.10.2 Scenario 2

Onshore cable route

497. There are 143 identified commuting / foraging features (i.e. hedgerows) along the onshore cable route, totalling approximately 5km of suitable commuting / foraging habitat (see Figure 22.5). This includes 88 important features for commuting and foraging bats (approximately 1.8km) and 55 other linear features (approximately 0.7km) which are suitable for commuting / foraging bats, but which have not been identified as 'important' within the landscape.

498. Furthermore, the 88 important features include five areas that have been identified as important core areas for barbastelle bat colonies at Paston Great Barn SAC and Old Hill Woods. Potential impacts upon the Paston Great Barn SAC are considered within section 22.7.5.1. Potential impacts upon the Paston Great Barn SAC colony are considered in the HRA Report and the conclusions of the HRA Report have been used to inform the assessment presented below. The HRA Report (document reference 5.3) has been submitted as part of the DCO application.

499. Potential impacts on the Old Hill Woods colony is considered with the wider impact assessment upon commuting / foraging bats below.

500. As part of the embedded mitigation, individual hedgerow crossings have been reduced from 35m to 13m wide, resulting in a 60% reduction in the amount of commuting or foraging habitat removal required during the construction phase of the works. In light of this embedded mitigation, the following impacts are anticipated upon the important features:

- Direct loss of up to 1.1km of hedgerow foraging / commuting habitat across 88 important features to facilitate cable trenching for the duration of the two year cable trenching works;
- Fragmentation of foraging / commuting habitat for bats commuting or foraging across 88 important features to facilitate cable trenching for the duration of the two year cable trenching works, including 16 hedgerows located within core

foraging areas within the home ranges for the Old Hills and Paston Great Barn maternity colonies¹⁸, of which approximately 12 will be required to remain open during the two year cable pulling works; and

- Indirect effects upon commuting bats arising from construction lighting.

501. The following impacts are anticipated upon the commuting foraging / commuting features not classified as important:

- Direct loss of up to 0.7km of hedgerow foraging / commuting habitat across 55 features to facilitate cable trenching for the duration of the two year cable duct installation;
- Fragmentation of foraging / commuting habitat for bats commuting or foraging across 55 features to facilitate cable trenching for the duration of the two year cable duct installation, of which approximately 11 will be required to remain open during the two year cable pulling works; and
- Indirect effects upon commuting bats arising from construction lighting, for the duration of the two year duct installation, plus a further 16 weeks per annum in any one area during the two year cable pulling works.

502. No active bat roosts have been found within the onshore project area. Three active bat roosts have been recorded within trees within the habitat and species study area. The following impacts are anticipated upon these bat roosts:

- Indirect effects upon the trees which support three active roosts arising from vehicle tracking and spoil storage within the root protection area of these trees for two years during the duct installation phase; and
- Indirect effects upon three bat roosts arising from construction lighting in works adjacent to these roosts for the two year duct installation, plus a further 16 weeks in any one area per annum in any one area during the two year cable pulling works.

503. Approximately 1.1km loss of important bat features and 0.7km loss of other bat features is of local scale in the context of the wider hedgerow resource within the region: this equates to approximately 0.22km and 0.12km of hedgerow lost per km², which represents approximately 5% and 3% of the typical amount of hedgerow per km² within the county (NBP, 2009), which is an effect of low magnitude.

504. Habitat fragmentation for 88 important features and 55 other features represents fragmentation across multiple habitat networks across the county. Gaps of 13m are over the threshold above which fragmentation effects may occur (BCT guidance advises that gaps should not exceed 10m (BCT, 2012)). As such, fragmentation effects for those species which are most closely associated with hedgerows for

¹⁸ Please refer to the HRA Report for full details on the hedgerows within the Paston Great Barn core foraging area potentially affected during construction of the project.

commuting or foraging (common pipistrelle, soprano pipistrelle, brown long-eared, Daubenton's, and barbastelle) may potentially still occur. This effect is anticipated to be of medium magnitude.

505. Indirect effects and impacts upon roosting bats are anticipated to be localised and of low likelihood of disturbing commuting or foraging bats, therefore this magnitude of effect is negligible.

Unsurveyed areas

506. Approximately 53 linear features were identified by the Norfolk Living Map and aerial photography but not surveyed for their suitability to support commuting or foraging bats. Under a precautionary approach, it has been assumed that these features may provide valuable habitat for commuting or foraging bats. The impacts upon these linear features will be in line with those set out above for important features.
507. 20 trees and structures were not surveyed during the 2017 and 2018 Bat Activity Survey. A further 11 areas within the habitat and species study area were identified by the Norfolk Living Map and aerial photography as potentially containing additional trees which may be suitable to support roosting bats. As such, and by applying a precautionary approach, it has been assumed that these trees may support roosting bats. Therefore, the following effects may occur (in addition to those identified above):
- A risk of killing or injuring roosting bats when trees are removed to facilitate cable trenching works; and
 - A risk of destroying active roosts when trees are removed to facilitate cable trenching works.
508. These effects would result in the killing or injuring of individuals across a range of habitats within the habitats and species study area. As such the potential magnitude of effect is high.

Onshore project substation

509. There are four identified commuting / foraging features (i.e. hedgerows) within the onshore project substation, totalling approximately 790m of hedgerow (of which 270m is species-rich hedgerow, 360m species-poor hedgerow with trees, and 160m species-rich hedgerow with trees) (see Figure 22.5). Approximately 430m of this hedgerow is identified as important bat commuting / foraging habitat, while 360m is identified as other habitat supporting commuting / foraging bats.
510. The following impacts are anticipated upon these features:
- Permanent loss of up to 30m of important foraging / commuting habitat;

- Permanent loss of up to 360m of other foraging / commuting habitat;
- Temporary loss of up to 400m of important foraging / commuting habitat during the 30 month construction phase;
- Fragmentation of foraging / commuting habitat by severing the commuting route for bats commuting north-south through the onshore project area; and
- Indirect effects upon commuting bats arising from construction lighting.

511. No active bat roosts have been found within the habitat and species study area. As such no change is anticipated upon roosting bats.
512. An approximately 30m permanent loss and 400m temporary loss of important bat features and 360m loss of other bat features is of local scale in the context of the wider hedgerow resource within the region, which is an effect of low magnitude.
513. Fragmentation of habitat networks that have been identified as important for supporting commuting and foraging bats will occur. Gaps of up to 30m will be generated, which cannot be traversed by commuting bats (any species). This effect is a localised but permanent effect. Figure 22.5 shows the alternative habitat networks available within the immediate surroundings, which will mitigate some of the potential effect. However, as the commuting route has been identified as supporting an important bat population, the magnitude of effect is assessed to be medium.

National Grid substation extension and overhead line modifications

514. There are four identified commuting / foraging features (i.e. hedgerows) within the area of the National Grid substation extension and overhead line modifications, totalling approximately 210m of species-poor hedgerow (see Figure 22.5). These hedgerows are assessed as not providing important bat commuting / foraging habitat, but are used by commuting / foraging bats (i.e. are 'other' bat features).
515. The following impacts are anticipated upon the other bat features:
- Direct loss of up to 210m of other foraging / commuting habitat during the 30 month construction phase; and
 - Indirect effects upon commuting bats arising from construction lighting.
516. No active bat roosts have been found within the habitat and species study area. As such no change is anticipated upon roosting bats.
517. Approximately 210m loss of bat features not classified as 'important' is of local scale in the context of the wider hedgerow resource within the region, which is an effect of negligible magnitude.

Impact without mitigation

518. During works on the onshore cable route and onshore project substation the potential loss of bat features is anticipated as having an effect of low magnitude and

the fragmentation of habitat networks is anticipated as having an effect of medium magnitude. Potential indirect effects and loss of bat features at the National Grid substation extension are anticipated to have an effect of negligible magnitude.

519. In accordance with Table 22.4 bats are of high importance.

520. Without mitigation, the greatest effect arising from the project is medium magnitude on a high importance receptor, which results in an impact of at worst **major adverse** significance.

Unsurveyed areas

521. Without mitigation, the greatest potential effect arising from the unsurveyed areas is high magnitude on a high importance receptor, resulting in an impact of at worst **major adverse** significance.

Mitigation

522. The following mitigation measures will be adhered to for all important bat commuting / foraging features:

- Hedgerow removal will be programmed for winter where possible, to give bats time to adjust to the change prior to the maternity period. Hedgerows will be removed as close to the onset of works as possible, and works will not commence after nights of poor weather (in case of bad weather roosts being used);
- Hedgerow replanting will where possible follow in the first winter after construction, with the exception of the 6m gap required for the running track (BCT, 2012). Replanting will follow guidance within the Norfolk hedgerow BAP and will include appropriate species for north-east Norfolk (NBP, 2009), including ground flora planting designed to encourage insect biomass (BCT, 2012). Future hedgerow management to include allowing standard trees to develop to improve quality of the hedgerow as a foraging resource. Hedges will be double-planted with 2m grassland strips on both sides so there is always a leeward side to forage;
- Subject to landowner permissions, the 16 hedgerows that are important for foraging and commuting bats of the Paston Great Barn / Old Hills maternity colonies would be left to become overgrown either side of the section to be removed prior to construction. Hedgerows would be allowed to become overgrown within the onshore cable route width, therefore at each hedgerow a total of up to 22m will be left to become overgrown in this manner. This would be undertaken to improve the quality of the surrounding hedgerow as a resource for commuting and foraging bats (Bates, 2010);
- The project will seek to avoid mature trees within hedgerows through the micro-siting of individual cables, in order to retain as many mature trees as possible

given the benefits they provide within linear commuting / foraging features (following Boughley *et al.*, 2011); and

- Mitigation planting at the onshore project substation has been designed to replace and improve all ecological connections currently located within the onshore project substation footprint. This includes creation of new woodland strips connecting the commuting / foraging resources severed by the construction phase works. The location of this mitigation planting can be seen in Chapter 29 Landscape and Visual Impact Assessment.
- A Hedgerow Mitigation Plan will be developed in consultation with Natural England prior to the removal of hedgerows. This mitigation plan will detail the reinstatement approach for hedgerows removed during construction and the monitoring and maintenance requirements following hedgerow planting. This commitment is captured within the OLEMS (document reference 8.7).

523. The following mitigation measures will be adhered to for all other bat commuting / foraging features:

- Hedgerow removal will be programmed for winter where possible, to give bats time to adjust to the change prior to the maternity period. Hedgerows will be removed as close to the onset of works as possible, and works will not commence after nights of poor weather (in case of bad weather roosts being used);
- Hedgerow replanting will, where possible, follow in the first winter after construction, with the exception of the 6m gap required for the running track (BCT, 2012). Replanting will follow guidance within the Norfolk hedgerow BAP (NBP, 2009). Future hedgerow management to include allowing standard trees to develop to improve quality of the hedgerow as a foraging resource; and
- The project will seek to avoid mature trees within hedgerows through the micro-siting of individual cables, in order to retain as many mature trees as possible given the benefits they provide within linear commuting / foraging features (following Boughley *et al.*, 2011).

524. The three trees which support bats roosts located within the habitat and species study area will be subject to the following mitigation measures to ensure that the construction works do not affect the tree's health or the long term survival of the bat roost:

- A tree survey of the trees will be constructed prior to works; and
- The tree's Root Protection Area (RPA) will be calculated and appropriate measures (e.g. fencing off sensitive areas, use of ground protection matting, etc.) will be deployed within the trees' RPA.

525. To avoid indirect effects arising from the construction phase works, the following mitigation measures will be adhered to:

- Construction phase lighting will be used between 7am-7pm in low light conditions, with lower-level security lighting outside of these times; and
- All temporary lighting to be designed in line with the BCT and ILP *Bats and Artificial Lighting in the UK* guidance (BCT and ILP, 2018). This will include the use of directional lighting during construction.

526. The measures described above is captured in the OLEMS (document reference 8.7).

Unsurveyed areas

527. 20 trees and structures were not surveyed during the 2017 and 2018 bat emergence / re-entry survey and therefore they will need to be surveyed during the post-consent survey effort to confirm whether they support roosting bats.

528. If bats or signs of bats are found in any of the features, appropriate mitigation measures would be developed adhering to Natural England Standing Advice (Natural England, 2015b), which may include blocking up features, soft felling and timing of works. An EPS licence may be necessary to work on or remove the trees.

529. The approach to unsurveyed areas described above is captured in the OLEMS (document reference 8.7).

Impact following mitigation

530. Following implementation of these mitigation measures, the potential fragmentation effects will be reduced, although will not be completely avoided until the mitigation planting matures. In the long-term, once planting matures, there will be a beneficial effect upon this receptor. However, given the duration of these temporary effects before reaching this point (up to 11 years for restored hedgerows to be of greater commuting / foraging value than that lost during construction), a residual impact of **moderate adverse** significance is expected to remain.

Unsurveyed areas

531. Following implementation of these mitigation measures, the risk of killing or injuring bats will be reduced to a negligible level and the potential fragmentation effects will be reduced, although fragmentation effects will remain while the mitigation planting matures. In the long-term, once planting matures, there will be a beneficial effect upon this receptor. However, given the duration of these temporary effects before reaching this point (up to 11 years for restored hedgerows to be of greater commuting / foraging value than that lost during construction), a residual impact of **moderate adverse** significance is expected to remain.

22.7.5.10.3 Scenario 1

Onshore cable route

532. Under a worst case, a running track may be required at up to approximately 23 hedgerows during the cable pulling works. A maximum hedgerow gap of 6m will be retained, if required, for the duration of the two-year cable pulling works to allow for the running track. All UK bat species are considered able to traverse gaps of 10m or less (JNCC, 2001; BCT, 2012). Cable pulling will take place 7am-7pm and construction lighting adjacent to these hedgerows will not be required. The duration and scale of this effect is anticipated to give rise to an effect of negligible magnitude.

Onshore project substation

533. There are four identified commuting / foraging features (i.e. hedgerows) within the onshore project substation, totalling approximately 360m of species-rich hedgerow with trees (see Figure 22.5). This hedgerow is identified as important bat commuting / foraging habitat.

534. The following impacts are anticipated upon these features:

- Permanent loss of up to 240m of important foraging / commuting habitat;
- <https://royalhaskoningdhv.box.com/s/jpkqzok6m1uaz3tf1j2esy3oufjxd8k8> Temporary loss of up to 120m of important foraging / commuting habitat during the 30 month construction phase;
- Fragmentation of foraging / commuting habitat by severing the commuting route for bats commuting north-south through the onshore project area; and
- Indirect effects upon commuting bats arising from construction lighting.

535. No active bat roosts have been found within the habitat and species study area. As such no change is anticipated upon roosting bats.

536. An approximately 240m permanent loss and 120m temporary loss of important bat features is an effect of low magnitude. Fragmentation of habitat networks that have been identified as important for supporting commuting and foraging bats will occur. Gaps of up to 240m will be generated, which cannot be traversed by commuting bats (any species). This effect is a localised but permanent effect on the 240m affected area. Figure 22.5 shows the alternative habitat networks available within the immediate surroundings, which will mitigate some of the potential effect. However, as the commuting route has been identified as supporting an important bat population, the magnitude of effect is assessed to be medium.

National Grid substation extension

537. There are no identified commuting / foraging features (i.e. intact hedgerows) within the area of National Grid substation extension. Therefore no change is anticipated upon this receptor under Scenario 1.

Impact without mitigation

538. During works on the onshore cable route potential loss of bat features is anticipated as having an effect of negligible magnitude. The potential loss of bat features at the onshore project substation is anticipated as having an effect of low magnitude and the fragmentation of habitat networks is anticipated as having an effect of medium magnitude. No change is anticipated on bats as a result of the National Grid substation extension under Scenario 1.
539. Without mitigation, the greatest effect arising from the project is medium magnitude on a high importance receptor, which results in an impact of at worst **major adverse** significance.

Mitigation

540. The mitigation set out under Scenario 2 (see section 22.7.5.10.2) for minimising disturbance effects and for pre-construction surveys would be adhered to under Scenario 1.

Impact following mitigation

541. Following implementation of these mitigation measures, the short-term habitat fragmentation effects will be mitigated through enhanced planting at the onshore project substation. As such, the residual effect is of negligible magnitude, which is expected to result in a **minor adverse** residual impact following mitigation.

22.7.5.11 Impact 11: Water vole

22.7.5.11.1 Scenario 1 and Scenario 2

Landfall

542. There are no watercourses within or adjacent to the landfall which are suitable for water voles. As such there will be no change upon water voles due to the proposed landfall works under either scenario.

22.7.5.11.2 Scenario 2

Onshore cable route

543. To date, field signs of water vole have been recorded on seven watercourses along the onshore cable route, as shown on Figure 22.7.
544. Of these seven watercourses, only one has recorded a high density of water voles – the River Wensum (WV32) (see Figure 22.7).
545. Three of the seven watercourses where water voles have been recorded, i.e. the River Wensum, the River Bure and the Wendling Beck at Dillington, will be subject to trenchless crossing techniques (e.g. HDD) as part of embedded mitigation to avoid potential impacts at these locations. Table 22.24 summarises the potential effects on

these and on the remaining four watercourses where water voles have been recorded.

Table 22.24 Water vole impacts along the cable route (see Figure 22.7)

Watercourse (see Figure 22.7 for locations)	Effects	% of local of habitat affected	Magnitude of effect (without mitigation)
WV13	None, trenchless crossing techniques (e.g. HDD) used.	0%	No change
WV14	<ul style="list-style-type: none"> • A risk of killing or injuring water voles which are undertaking foraging within the watercourse; • Temporary loss of approximately 45m of suitable watercourse habitat, which is functionally connected to an identified water vole burrow; • Fragmentation of the local drainage ditch network; • A risk of habitat degradation due to pollutant release during the construction phase. 	10%	Medium
WV15	As per WV14.	10%	Medium
WV22	None, trenchless crossing techniques (e.g. HDD) used.	0%	No change
WV32	None, trenchless crossing techniques (e.g. HDD) used.	0%	No change
NB-WV01	As per WV14.	10%	Medium
NB-WV07	As per WV14.	10%	Medium
NB-WV10	As per WV14.	10%	Medium

546. The maximum magnitude of effect upon these receptors during construction works along the cable route is anticipated to be medium.

Unsurveyed areas

547. An additional three watercourses have been identified using the Norfolk Living Map and aerial photography which may be optimal habitat for water voles. A further two watercourses were scoped into the 2017 Water Vole Survey but were unable to be surveyed in 2017 or 2018 due to landowner access restrictions. During construction works within these watercourses there is a potential risk of killing or injuring water voles which are using the bank habitat for foraging/commuting. There is also a risk of habitat degradation due to pollutant release during the construction phase or risk of destroying water vole burrows. There is also the potential for a temporary loss of approximately 35m of suitable habitat functionally connected to identified water vole burrows at ten locations, which could also result in fragmentation of the local water vole habitat network.

548. The impacts will occur for up to eight weeks at each watercourse (duct installation)

plus a further 16 weeks per annum during the following two year cable pulling element of the construction phase, and therefore will be short-term for water voles' life-cycle but regularly recurring over a period of four years. The impacts will be localised on narrow sections of a water vole's territory in each location. As the populations recorded on these watercourses are currently unknown and may potentially be high, the magnitude of effect is anticipated to be medium.

Onshore project substation

549. One watercourse (a ditch, WV05) is located within the onshore project substation temporary construction compound zone. A single potential water vole burrow was recorded along this watercourse during the 2017 Water Vole Survey (Figure 22.7). This burrow is located approximately 350m west of the onshore project substation.
550. Water vole territories can extend up to 500m, as such water voles may be active adjacent to the onshore project substation. There is a risk of killing or injuring water voles which are using the bank habitat for foraging/commuting. There is also a risk of habitat degradation due to pollutant release during the construction phase. These risks will occur for up to 30 months during construction of the onshore project substation. Noise and visual disturbance are unlikely to have a significant effect on water voles (Dean *et al.*, 2016). The construction phase works will affect approximately 5% of the available foraging habitat within the drainage network at this location. As such, the magnitude of effect is anticipated to be low.

National Grid substation extension and overhead line modifications

551. Two watercourses (ditches) are located adjacent to the National Grid substation extension. No water vole field signs were recorded along these watercourses, but a single potential water vole burrow was recorded along an adjacent connecting watercourse during the 2017 Water Vole Survey (WV05, Figure 22.7). This burrow is located approximately 40m south of the National Grid substation extension works.
552. Water vole territories can extend up to 500m, as such water voles may be active adjacent to the National Grid substation extension. There is a risk of killing or injuring water voles which are undertaking bankside foraging adjacent to the laydown area. There is also a risk of habitat degradation due to pollutant release during the construction phase. Noise and visual disturbance are unlikely to have a significant effect on water voles (Dean *et al.*, 2016). The construction phase works will affect approximately 5% of the available foraging habitat within the drainage network at this location. As such, the magnitude of effect is anticipated to be low.

Impact without mitigation

553. Potential effects on water voles of low magnitude are anticipated at as a result of the works at the onshore project substation and National Grid substation extension and of medium magnitude during construction of the onshore cable route.

554. In accordance with Table 22.4 water voles are of medium importance.
555. Without mitigation, the greatest effect arising from the project is medium magnitude on a medium importance receptor, resulting in an impact of at worst **moderate adverse** significance.

Unsurveyed areas

556. Assuming that water voles are found within the unsurveyed areas, without mitigation, the greatest effect arising from the project is medium magnitude on a medium importance receptor, resulting in an impact of at worst **moderate adverse** significance.

Mitigation

557. In order to minimise the direct effects upon water voles during the construction phase, the following mitigation measures will be implemented:
- For works at watercourses WV14 and WV15 (both Penny Spot Beck), NB-WV01, NB-WV07 and NB-WV10 displacement under licence of the width of the cable route (i.e. 35m) will be conducted prior to works. Displacement will follow the protocol set out in Appendix 1 of the Water Vole Mitigation Handbook (2016). Details of this protocol will be agreed with Natural England in advance of construction; a pre-construction survey will be undertaken prior to work to identify the current distribution of water voles within the habitat and species study area; post-construction monitoring during the breeding season one year after completion of construction will be undertaken to determine the status of the water vole population; habitats will be fully reinstated following works. The guidelines for habitat restoration set out in Water Vole Mitigation Handbook (2016) will be adhered to; and for works to habitats immediately adjacent to WV05, a pre-construction survey will be undertaken to ensure that the water vole populations have not changed. If no field signs of water voles are found within 50m of the project, no further mitigation is required.
558. These measures are captured within the OLEMS (document reference 8.7) submitted with the DCO application.

Unsurveyed areas

559. A pre-construction survey of the two inaccessible watercourses plus the potential additional three watercourses will be undertaken post-consent.
560. For all watercourses where signs of water vole activity are found, the mitigation set out above would be adhered to.

Impact following mitigation

561. Following implementation of these mitigation measures, the potential magnitude of effect on water voles is reduced to at most low, and a residual impact of **minor**

adverse significance would remain.

Unsurveyed areas

562. Following implementation of these mitigation measures, the potential magnitude of effect on water voles within the unsurveyed areas is reduced to at most low, and an impact of **minor adverse** significance would remain following mitigation.

22.7.5.11.3 Scenario 1

Onshore cable route

563. Under Scenario 1, water voles would have been displaced from the five watercourses which would need the running track to be reinstated across them. As water vole would have already been displaced from these watercourses, no change is anticipated upon this receptor.

Onshore project substation

564. One watercourse (a ditch, WV05) is located within the onshore project substation temporary construction compound zone. A single potential water vole burrow was recorded along this watercourse during the 2017 Water Vole Survey (Figure 22.7). This burrow is located approximately 350m west of the onshore project substation.

565. Water vole territories can extend up to 500m, as such water voles may be active adjacent to the onshore project substation. There is a risk of killing or injuring water voles which are using the bank habitat for foraging/commuting. There is also a risk of habitat degradation due to pollutant release during the construction phase. These risks will occur for up to 30 months during construction of the onshore project substation. Noise and visual disturbance are unlikely to have a significant effect on water voles (Dean *et al.*, 2016). The construction phase works will affect approximately 5% of the available foraging habitat within the drainage network at this location. As such, the magnitude of effect is anticipated to be low.

National Grid substation extension and overhead line modifications

566. Under Scenario 2, there are no watercourses located within 300m of the National Grid substation extension works. As such, there will be no change upon this receptor for Scenario 1.

Impact without mitigation

567. Potential effects of low magnitude on water voles are anticipated at as a result of the works at the onshore project substation.

568. In accordance with Table 22.4 water voles are of medium importance.

569. Without mitigation, the greatest effect arising from the project is low magnitude on a medium importance receptor, resulting in an impact of at worst **minor adverse** significance.

Mitigation

570. In order to minimise the direct effects upon water voles during the construction phase, the following mitigation measures will be implemented:

- A pre-construction survey will be undertaken prior to work to identify the current distribution of water voles within the habitat and species study area.

Impact following mitigation

571. Following implementation of these mitigation measures, the potential magnitude of effect on water voles is reduced to at most low, and a residual impact of **minor adverse** significance would remain.

22.7.5.12 Impact 12: Otters

22.7.5.12.1 Scenario 1 and Scenario 2

Landfall

572. There are no watercourses or coastal areas within or adjacent to the landfall which are suitable for otter. As such there will be no change upon otter due to the proposed landfall works under either scenario.

Onshore project substation

573. There are no watercourses within or adjacent to the onshore project substation which are suitable for otters. As such there will be no change upon otters due to the proposed onshore project substation works under either scenario.

National Grid substation extension and overhead line modifications

574. There is one watercourse located within the National Grid substation extension temporary works area is assessed as being suitable for otters, with one potentially suitable otter resting place being identified at TN12 (Figure 22.5), approximately 200m from the National Grid substation extension temporary works area. No otter field signs were observed at this location, so this is not considered to be an active otter resting place. As such, no direct effects will occur.

575. There is potential for indirect effects on otters from noise and lighting associated with the construction works under both scenarios. This will occur for a maximum duration equivalent to construction of the National Grid substation extension and overhead line modification (up to 30 months). As otter territories are very large (up to 30km) and these effects will be short-term and extremely localised, and not near any confirmed otter resting sites, this is likely to produce an effect of negligible magnitude.

22.7.5.12.2 Scenario 2

Onshore cable route

576. No otter holts or resting places were recorded within the habitat and species study

area. A total of seven watercourses within the onshore cable route were assessed as being suitable to support commuting otter, with evidence of otter noted at the River Bure, River Wensum (and associated drains) and the North Walsham and Dilham Canal.

577. All seven of these watercourses will be subject to trenchless crossing techniques (e.g. HDD) as part of embedded mitigation to avoid potential impacts at these locations. As a consequence, no direct effects upon otters are anticipated.
578. There is potential for indirect effects on otters due to noise and lighting associated with the construction phase works. This will occur for the maximum duration of the trenchless crossing works (approximately eight weeks) and for a further 16 weeks per annum during the two year cable pulling element of the construction phase at any one location. As otter territories are very large (up to 30km) and these effects will be short-term and extremely localised, and not near any confirmed otter resting sites, this is likely to produce an effect of negligible magnitude.

Impact without mitigation

579. No change is anticipated on otters as a result of works at the landfall or onshore project substation. Potential indirect effects of negligible magnitude are anticipated at the National Grid substation extension and the onshore cable route.
580. In accordance with Table 22.4 otters are of high importance.
581. Without mitigation, the greatest effect arising from the project is of negligible magnitude on a high importance receptor, resulting in an impact of at worst **minor adverse** significance.

Mitigation

582. In order to minimise the indirect effects upon otters during the construction phase, the following mitigation measures will be implemented:
- Wherever possible, night-time working near watercourses will be avoided or else minimised; and
 - Exit ramps from excavations will be provided at night near watercourses with confirmed presence, to provide otters with a means of escape.
583. These measures are captured within the OLEMS (document reference 8.7) submitted as part of the DCO application.

Impact following mitigation

584. Following implementation of these mitigation measures, the potential magnitude of effect on otters remains negligible, and a residual impact of **minor adverse** significance remains.

22.7.5.12.3 Scenario 1

Onshore cable route

585. There is a potential for indirect effects on otters due to noise and lighting associated with the cable pulling works. This will occur for up to 16 weeks per annum during the two year cable pulling at any one location. As otter territories are very large (up to 30km) and these effects will be short-term and extremely localised, and not near any confirmed otter resting sites, this is likely to produce an effect of negligible magnitude.

Impact without mitigation

586. As in Scenario 2, there is the potential for indirect effects of negligible magnitude during works at the National Grid substation extension and the onshore cable route.

587. Without mitigation, the greatest effect arising from the project is of negligible magnitude on a high importance receptor, resulting in an impact of at worst **minor adverse** significance.

Mitigation

588. The mitigation set out under Scenario 2 (22.7.5.12.2) would be adhered to for Scenario 1 works.

Impact following mitigation

589. Following implementation of these mitigation measures, the potential magnitude of effect on otters remains negligible, and a residual impact of **minor adverse** significance remains following mitigation.

22.7.5.13 Impact 13: Great Crested Newts

22.7.5.13.1 Scenario 1 and Scenario 2

Landfall

590. There are no standing water bodies within 250m of the landfall works. As such there will be no change upon great crested newts due to the proposed landfall works under both scenarios.

Onshore project substation

591. There are no water bodies located within the onshore project substation which are suitable for supporting great crested newts or in which great crested newts have been found under either scenario.

592. There is one water body located within 500m of the permanent works at the onshore project substation which has been found to support breeding populations of great crested newts (see Figure 22.6).

593. For this water body located within 500m of the temporary works, the following impacts may occur:
- Risk of killing or injuring foraging newts during the construction phase;
 - Temporary loss of a negligible amount of suitable habitat (<0.1ha) due to physical features in the landscape separating these ponds from the onshore project area (see Figure 22.6) for approximately 30 months; and
 - Temporary habitat fragmentation of a negligible amount of suitable habitat (<0.1ha) for approximately 30 months.
594. The landscape surrounding the pond where presence has been found indicates that it is very unlikely that the onshore project area overlaps with the territorial ranges of individuals using these breeding ponds. Pond TF9010-50 is located approximately 230m from the onshore substation temporary works area (see Figure 22.6), which is located within arable habitat (suboptimal for foraging newts) and is separated from that area by a hedgerow habitat. In light of this, based on the survey information to date it is considered unlikely that great crested newts are actively foraging within the onshore project area. The low likelihood of occurrence in addition to its localised and small scale nature represents an effect of negligible magnitude.

Unsurveyed areas

595. There are no unsurveyed water bodies located within the footprint of the onshore substation.
596. There are two unsurveyed standing water bodies located within 500m of the temporary works area at the onshore substation. Under a precautionary approach, it is therefore assumed at this time that these water bodies support great crested newts.
597. For both of these standing water bodies, the following impacts may occur:
- Risk of killing or injuring breeding and foraging newts during the construction phase; and
 - Temporary habitat loss of approximately 30m of suitable habitat (hedgerow foraging habitat) for approximately 30 months.
598. The landscape surrounding these two ponds indicates that it is very unlikely that the onshore project area overlaps with the terrestrial ranges of potential great crested newts using these ponds. Pond TF9010-31 is located adjacent to Necton Wood, which represents higher quality foraging and hibernating habitat and 150m from the onshore substation, separated from it by an arable field; TF9009-33 is located approximately 400m from the onshore project area and is surrounded by scrub and hedgerows (see Figure 22.6). On this basis, it is considered unlikely that great crested newts are actively foraging within the onshore substation area. The low likelihood of

great crested newts being present in addition to the localised and small scale nature of the effect represents an effect of negligible magnitude.

National Grid substation extension and overhead line modifications

599. There are no water bodies located within or up to 500m from the National Grid substation extensions and overhead line modifications which are suitable for supporting great crested newts or in which great crested newts have been found. As such there will be no change upon great crested newts due to the National Grid substation extension and overhead line modifications under either scenario.

Unsurveyed areas

600. There are no unsurveyed water bodies located within the National Grid substation extension and overhead line modifications. There are two unsurveyed water bodies located within 500m of the permanent works at the National Grid substation extensions and overhead line modifications. The location of these water bodies is shown on Figure 22.6. Under a precautionary approach, it is therefore assumed at this time that these water bodies support great crested newts.

601. For these two water bodies, the following impacts may occur:

- Risk of killing or injuring breeding and foraging newts during the construction phase; and
- Temporary habitat loss of approximately 900m of suitable habitat (hedgerow foraging habitat along the A47) for approximately 30 months.

602. These potential effects, if realised, would occur on a local scale to one or two discrete populations. As a consequence, this represents a low magnitude of effect.

22.7.5.13.2 Scenario 2

Onshore cable route

603. There are no confirmed great crested newt breeding ponds located within the onshore project area.

604. There are four water bodies located within the onshore project area which are suitable for supporting great crested newts, but in which no great crested newts were recorded during the 2017 and 2018 great crested newt surveys.

605. Embedded mitigation has led to trenchless techniques (e.g. HDD) being proposed at two of these four standing water bodies. The remaining two will be temporarily lost during construction.

606. There are three water bodies located within 250m of the temporary works along the cable route which have been found to support breeding populations of great crested newts (see Figure 22.6):

- TF9614-154
- TF9614-155
- TG0721-256

607. For water bodies located within 250m of the temporary works, the following impacts may occur:

- Risk of killing or injuring foraging newts during the construction phase;
- Temporary habitat loss of a negligible amount of suitable habitat (<0.1ha) due to physical features in the landscape separating these ponds from the onshore project area (see Figure 22.6) for approximately two years plus a further 16 weeks per annum during the two year cable pulling; and
- Temporary habitat fragmentation of a negligible amount of suitable habitat (<0.1ha) for approximately two years plus a further 16 weeks per annum over two years during the cabling pulling.

608. The landscape surrounding the three ponds where presence has been found indicates that it is very unlikely that the onshore project area overlaps with the terrestrial ranges of individuals using these breeding ponds. Ponds TF9614-154 and TF9614-155 are separated from the onshore project area by flowing water (the Wendling Beck) and a minor road and TG0721-256 is located approximately 160m from the onshore project area, and is located within a domestic garden and surrounded by localised barrier to movement. In light of this and based on the survey information to date, it is considered unlikely that great crested newts are actively foraging within the onshore project area. The low likelihood of impact in addition to the localised and small scale nature of the effect represents an effect of negligible magnitude.

Unsurveyed areas

609. There are five unsurveyed water bodies located within the onshore cable route. The location of these water bodies is shown on Figure 22.6.

610. There are a further 111 unsurveyed standing water bodies located within 250m of the temporary works along the cable route. Under a precautionary approach, it is therefore assumed at this time that these water bodies potentially support great crested newts.

611. For the 116 standing water bodies identified above, the following impacts may occur:

- Risk of killing or injuring breeding and foraging newts during the construction phase;
- Temporary habitat loss of up to six potential breeding ponds;

- Temporary habitat loss of approximately 13.42ha of suitable habitat (including grassland foraging habitat, woodland edges for hibernation, areas of scrub and other marginal habitats) for approximately two years plus a further 16 weeks per annum during the two year cable pulling; and
- Temporary habitat fragmentation for approximately two years plus a further 16 weeks per annum over two years during the cable pulling.

612. These potential effects, if found to occur, will occur on a large spatial scale across the county. As a consequence, this represents a high magnitude of effect.

Impact without mitigation

613. Potential effects on great crested newts of negligible magnitude are anticipated as a result of the onshore cable route and onshore project substation. No change is anticipated as a result of the landfall or National Grid substation extension.

614. In accordance with Table 22.4 great crested newts are of high importance.

615. Without mitigation, the greatest magnitude arising from the project is negligible, on a high importance receptor, resulting in an impact of at worst **minor adverse** significance.

Unsurveyed areas

616. The presence of unsurveyed water bodies is anticipated to have an effect of negligible magnitude at the onshore project substation, low at the National Grid substation extension and high on the onshore cable route.

617. Without mitigation, the greatest potential magnitude arising from unsurveyed areas is high, on a high importance receptor, resulting in an impact of at worst **major adverse** significance.

Mitigation

618. A pre-construction presence / absence survey of all water bodies located within 250m of the onshore project area and 250m of each confirmed breeding pond will be undertaken post-consent, one year in advance of construction to ensure that the local great crested newt population distribution has not changed. As a presence / absence survey, eDNA methods would be suitable.

619. As the likelihood of encountering great crested newts during construction is low, but a risk of killing or injuring great crested newts exists, a precautionary method of working (PMoW) will be followed during the construction phase in areas within 250m of all confirmed breeding ponds (TF9614-154, TF9614-155, TG0721-256 and TF9010-50). The PMoW will be agreed with Natural England prior to construction, and would include details of the locations of terrestrial habitat affected surrounding

identified great crested newt breeding ponds, habitat manipulation and reinstatement required, and ecological supervision of the works.

620. These measures are captured within the OLEMS (document reference 8.7) provided with the DCO application.

Unsurveyed areas

621. Five water bodies located within the onshore project area plus 111 water bodies located within the great crested newt study area (i.e. a total of 116 water bodies) were not surveyed during the 2017 and 2018 Great Crested Newt Surveys and will be surveyed during the post-consent survey effort to confirm whether they support breeding populations of great crested newts.
622. Should great crested newts be found within these water bodies, then mitigation will be required. The potential worst case mitigation measures which might be required are set out within the Norfolk Boreas draft great crested newt mitigation licence application. The measures outlined within the draft licence application are in accordance with the Great Crested Newt Mitigation Guidelines (English Nature, 2001) and include:
- A capture and release programme under licence, including the use of exclusion fencing, receptor sites for translocation;
 - Terrestrial and aquatic habitat reinstatement;
 - Ecological supervision of the works; and
 - A programme of post-construction monitoring.
623. A draft great crested newt mitigation licence application will be prepared for Norfolk Boreas. The need for a final great crested newt mitigation licence application following post-consent surveys of the 120 unsurveyed water bodies will be agreed with Natural England via consultation post-consent. The agreed approach would be in accordance with the Great Crested Newt Mitigation Guidelines (English Nature, 2001).
624. All ecological management proposals is captured within the OLEMS (document reference 8.7).
625. Following consultation with Natural England held in March 2018, the project has discussed retaining the option to use 'alternative' approaches to delivering great crested newt mitigation under Natural England's new licensing policies (Policies '1' and '2') which have been in place since December 2016 (Natural England, 2016). These policies allow for the opportunity to undertake habitat creation or restoration both onsite and offsite (i.e. away from the development site boundary) as an alternative to trapping, translocating and excluding newts, provided it can be proven that this action is more likely to improve the conservation status of the species, and

that other criteria set out in the policies can be met. Following these discussions, the project has agreed to retain the option of using alternative approaches to delivering great crested newt mitigation under Natural England's new licensing policies alongside the 'traditional' approach outlined earlier in this section. At this stage, only the principles of such an alternative approach have been proposed. In summary, these are:

- **Breeding ponds:** Where direct impacts on confirmed breeding ponds (of any population size) are anticipated, traditional mitigation methods including fencing and trapping (ring-fencing) will be undertaken. However, rather than recreating the ponds within the onshore project area, it is proposed that habitat enhancement / pond restoration measures are undertaken within 500m of those breeding ponds affected. Further surveys will be required to support this approach;
- **Terrestrial habitats:** Where direct impacts upon terrestrial habitats are anticipated, it is recommended that unless a medium or high population has been recorded, or the pond is located within 50m of the onshore project area, exclusion fencing is not required. Where this is identified, instead habitat enhancement / pond restoration measures are undertaken within 500m of those breeding ponds affected. Further surveys will be required in order to support this approach; and
- The location of all offsite mitigation would be identified in partnership with the Norfolk Ponds Project (NPP) and Norfolk Farming and Wildlife Advisory Group (Norfolk FWAG). Where habitat creation is considered, the location of 'ghost pond' sites would be considered (Alderton *et al.*, 2017).

626. The final detailed approach to great crested newt mitigation will be agreed with Natural England via consultation on a final great crested newt mitigation licence post-consent.

Impact following mitigation

627. Following implementation of these mitigation measures, the magnitude of effect on great crested newts remains negligible, and a residual impact of **minor adverse** significance would be anticipated..

Unsurveyed areas

628. Following implementation of these mitigation measures, the potential magnitude of effect on great crested newts is reduced to negligible, resulting in a residual impact of **minor adverse** significance.

22.7.5.13.3 Scenario 1

Onshore cable route

629. Under Scenario 1, for water bodies located within 250m of the temporary works, the following impacts may occur:

- Risk of killing or injuring foraging newts during the cable pulling;
- Temporary habitat loss of a negligible amount of suitable habitat (<0.1ha) due to physical features in the landscape separating these ponds from the onshore project area (see Figure 22.6) for up to 16 weeks per annum during the two year cable pulling; and
- Temporary habitat fragmentation of a negligible amount of suitable habitat (<0.1ha) for up to 16 weeks per annum over two years during the construction phase.

630. As for Scenario 2, it is considered unlikely that great crested newts are actively foraging within the onshore project area. The low likelihood of impact in addition to the localised and small scale nature of the effect represents an impact of negligible magnitude.

Unsurveyed areas

631. Under Scenario 1, for the 111 standing water bodies identified above, the following impacts may occur:

- Risk of killing or injuring breeding and foraging newts during the cable pulling;
- Temporary habitat loss of approximately 13.42ha of suitable habitat (including grassland foraging habitat, woodland edges for hibernation, areas of scrub and other marginal habitats) for up to 16 weeks per annum during the two year cable pulling; and
- Temporary habitat fragmentation for up to 16 weeks per annum over two years during the construction phase.

632. As for Scenario 2, these potential effects, if found to occur, will occur on a large spatial scale across the county. As a consequence, this represents a high magnitude of effect.

Impact without mitigation

633. Potential effects on great crested newts of negligible magnitude are anticipated as a result of the onshore cable route and onshore project substation. No change is anticipated as a result of the landfall or National Grid substation extension.

634. Without mitigation, the greatest magnitude arising from the project is negligible, on a high importance receptor, resulting in an impact of at worst **minor adverse** significance.

Unsurveyed areas

635. The presence of unsurveyed water bodies is anticipated to have an effect of negligible magnitude at the onshore project substation, low at the National Grid substation extension and high on the onshore cable route.
636. Without mitigation, the greatest potential magnitude arising from unsurveyed areas is high, on a high importance receptor, results in an impact of at worst **major adverse** significance.

Mitigation

637. The mitigation set out under Scenario 2 (see section 22.7.5.13.2) would be adhered to for Scenario 1.

Impact following mitigation

638. Following implementation of these mitigation measures, the magnitude of effect on great crested newts remains negligible, and a residual impact of **minor adverse** significance will be expected following mitigation.

Unsurveyed areas

639. Following implementation of these mitigation measures, the potential magnitude of effect on great crested newts is reduced to negligible, resulting in a residual impact of **minor adverse** significance.

22.7.5.14 Impact 14: Reptiles

22.7.5.14.1 Scenario 1 and Scenario 2

Landfall

640. No suitable habitats for reptiles were identified during the 2017 Extended Phase 1 Habitat Survey at the landfall and as such no change upon common reptile species is anticipated to arise due to the proposed landfall works.

Onshore project substation

641. No suitable habitats for reptiles were identified during the 2017 or 2018 Extended Phase 1 Habitat Surveys within or adjacent to the onshore project substation. As such there will be no change to common reptile species due to the onshore project substation works.

National Grid substation extension and overhead line modifications

642. No suitable habitats for reptiles were identified during the 2017 or 2018 Extended Phase 1 Habitat Surveys within or adjacent to the National Grid substation extension zone. As such there will be no change to common reptile species due to the onshore project substation works.

22.7.5.14.2 Scenario 2

Onshore cable route

643. Small numbers of common reptile species have been recorded using the following seven locations within the habitat and species study area: NV-RE01, NV-RE04, NV-RE12, NV-RE13, NV-RE21, NB-RE03 and NB-RE05 (see Figure 22.10). Of these, NV-RE04, NV-RE12, NV-RE13, NB-RE03 and NB-RE05 are located within the onshore project area.
644. The construction phase works could risk killing or injuring reptiles which are active within habitats within or adjacent to the habitat mosaics within which they have been recorded. These risks will occur for approximately two years (duct installation) plus a further 16 weeks in any one area per annum during the following two year cable pulling, and therefore will be long-term for common reptiles' life-cycle. As the populations recorded in all areas of the route are small, the magnitude of impact is anticipated to be low.
645. Habitat loss and habitat fragmentation are considered unlikely to occur given that in all instances where reptiles have been recorded much more suitable habitat is found outside of the onshore project area.

Unsurveyed areas

646. Two areas of habitat mosaics were identified during the 2017 Extended Phase 1 Habitat Survey but due to landowner access restrictions, these areas were unable to be surveyed during the 2017 and 2018 survey effort. The potential exists therefore for the construction phase works to give rise to the following impacts at these locations:
- A risk of killing or injuring reptiles which are active within habitats within the onshore project area;
 - A risk of habitat loss at eight reptile habitat mosaics; and
 - A risk of habitat fragmentation at eight reptile habitat mosaics.
647. The impacts will occur approximately two years (duct installation) plus a further 16 weeks in any one area per annum during the following two year cable pulling, and therefore will be long-term for common reptiles' life-cycle. As the populations recorded in all areas of the route are currently unknown and may potentially be high, the magnitude of effect is anticipated to be medium.

Impact without mitigation

648. A potential change to reptiles is only anticipated at five isolated locations along the onshore cable route, where the low magnitude of effect is anticipated on a receptor of medium importance, resulting in an impact of **minor adverse** significance.

Unsurveyed areas

649. Without mitigation, the presence of unsurveyed areas along the onshore cable route has the potential for an effect of medium magnitude on a medium importance receptor, resulting in an impact of at worst **moderate adverse** significance.

Mitigation

650. The numbers of reptiles potentially affected is small but a risk of killing or injuring these reptiles exists. As such, a PMoW will be followed during the construction phase in those locations where reptiles have been recorded. The PMoW will be agreed with Natural England prior to construction, and will include details of pre-construction habitat manipulation, ecological supervision, and post-construction habitat reinstatement.
651. Details of the proposed PMoW is provided within the OLEMS (document reference 8.7) submitted as part of the DCO application.

Unsurveyed areas

652. If small populations of reptiles are found within the unsurveyed areas of suitable habitat mosaics, then the PMoW would also be implemented for these sites. If high populations of reptiles are found, then in addition to the adherence to the PMoW, a capture and release programme would also be implemented. The details of a capture and release programme would be drafted following the Reptile Mitigation Guidelines (Natural England, 2011) and agreed with Natural England in advance of works.
653. This approach to unsurveyed areas is captured within the OLEMS (document reference 8.7).

Impact following mitigation

654. Following implementation of these mitigation measures, the potential magnitude of effect on common reptiles is reduced to negligible. As a consequence, a residual impact of **minor adverse** significance is expected to remain..

Unsurveyed areas

655. Following implementation of these mitigation measures, the potential magnitude of effect on common reptiles is reduced to a negligible. As a consequence, a residual impact of **minor adverse** significance is expected to remain..

22.7.5.14.3 Scenario 1

Onshore cable route

656. Under Scenario 1, the cable pulling works could risk killing or injuring reptiles which are active along the running track adjacent to the habitat mosaics within which they have been recorded. These risks will occur for up to 16 weeks per annum during the

two year cable pulling, and therefore will be medium-term for common reptiles' life-cycle (although will recur over two consecutive seasons). As the populations recorded in all areas of the route are small, the magnitude of impact is anticipated to be negligible.

657. Habitat loss and habitat fragmentation are considered unlikely to occur given that in all instances where reptiles have been recorded much more suitable habitat is found outside of the onshore project area.

Impact without mitigation

658. A potential change to reptiles is only anticipated as part of the onshore cable route, where the effect of negligible magnitude is anticipated on a receptor of medium importance, resulting in an impact of **minor adverse** significance.

Mitigation

659. The mitigation set out under Scenario 2 (see section 22.7.5.14.2), including developing a PMoW, will be adhered to during the Scenario 1 works.

Impact following mitigation

660. Following implementation of these mitigation measures, the potential magnitude of effect on common reptiles remains negligible. As a consequence, a residual impact of **minor adverse** significance is expected to remain..

22.7.5.15 Impact 15: White-clawed crayfish

22.7.5.15.1 Scenario 1 and Scenario 2

Landfall

661. There are no watercourses within or adjacent to the landfall which are suitable for white-clawed crayfish. As such there will be no change upon white-clawed crayfish due to the proposed landfall works under either scenario.

Onshore cable route

662. There are two watercourses within the survey area, the River Wensum and the River Bure, which support white-clawed crayfish in reaches outside of the habitat and species study area. Both of these watercourses will be subject to trenchless crossing techniques (e.g. HDD) as part of embedded mitigation to avoid potential impacts at these locations. As such there will be no impact upon white-clawed crayfish associated with the onshore cable route under either scenario.

Onshore project substation

663. There are no watercourses within or adjacent to the onshore project substation which are suitable for white-clawed crayfish. As such there will be no impact upon white-clawed crayfish due to the proposed onshore project substation works under either scenario.

National Grid substation extension and overhead line modifications

664. There are no watercourses within or adjacent to the National Grid substation extensions and overhead line modifications which are suitable for white-clawed crayfish. As such there will be no impact upon white-clawed crayfish due to the National Grid substation extension and overhead line modifications under either scenario.

Impact without mitigation

665. As there is no pathway, there is anticipated to be **no impact** upon this receptor during the construction phase.

Mitigation

666. As there is no impact upon this receptor, no mitigation is proposed.

22.7.5.16 Impact 16: Other invertebrates

22.7.5.16.1 Scenario 1 and Scenario 2

Landfall, onshore project substation, National Grid substation extension and overhead line modifications

667. There are no suitable habitats within or adjacent to the landfall, onshore project substation, National Grid substation extension and overhead line modifications which are suitable for Desmoulin's whorl snail or the Norfolk hawkker. As such there will be no impact upon these receptors

22.7.5.16.2 Scenario 2

Onshore cable route

668. The Desmoulin's whorl snail is a qualifying feature of the River Wensum SAC. Consideration of the potential impacts upon this species is set out in section 22.7.5.1. As detailed in section 22.7.5.1, the 2017 and 2018 surveys did not record the presence of this species and therefore it is considered to be absent from within the onshore project area (i.e. the floodplain habitat on the southern bank of the River Wensum), and as such no impact is anticipated upon this receptor during the construction phase. The HRA Report (document reference 5.3) submitted with the DCO application provides full details of the potential effects upon the River Wensum SAC.

669. The Norfolk hawkker has been recorded in drainage ditches adjacent to the River Bure. The ditch where the Norfolk hawkker has been recorded and other suitable drainage ditches within the floodplain of the River Bure will be crossed using trenchless crossing techniques (e.g. HDD) as part of the embedded mitigation measures to avoid potential impacts to the River Bure. As a consequence, there is anticipated to be no change upon this receptor during the construction phase.

Impact without mitigation

670. As these species are either not present or being avoided through embedded mitigation, **no impact** is anticipated upon these receptors.

Mitigation

671. As there is no impact on this receptor, no mitigation is proposed. Good construction practice measures will be used when working within the River Wensum floodplain, and these are described in section 22.7.5.1.

22.7.5.16.3 *Scenario 1*

Onshore cable route

672. Under Scenario 1, as described in section 22.7.5.1.3, cable pulling works would not take place adjacent to the River Wensum floodplain. As a consequence, there will be no effects arising from the cable pulling and no change upon this receptor is anticipated.

Impact without mitigation

673. As these species are either not present or being avoided, **no impact** is anticipated upon these receptors.

22.7.5.17 *Impact 17: Fish*

22.7.5.17.1 *Scenario 1 and Scenario 2*

Landfall, onshore project substation, National Grid substation extension and overhead line modifications

674. There are no suitable habitats within or adjacent to the landfall, onshore project substation, National Grid substation extension and overhead line modifications which are suitable for notable fish species. As such there will be no change upon these receptors.

22.7.5.17.2 *Scenario 2*

Onshore cable route

675. Notable fish species have been identified in a number of watercourses crossing the onshore cable route. The potential effects upon these species are summarised in Table 22.25.

Table 22.25 Potential effects upon notable fish species

Watercourse	Species recorded	Record location	Potential effects
Wendling Beck	Bullhead Brown Trout	Within the habitats and species study area	Avoided through trenchless crossing techniques – indirect effects only

Watercourse	Species recorded	Record location	Potential effects
Penny Spot Beck	Bullhead Brown Trout	Within the habitats and species study area	Avoided through trenchless crossing techniques – indirect effects only
River Wensum	Bullhead Brown Trout Brook lamprey	Upstream and downstream of the habitats and species study area	Avoided through trenchless crossing techniques – indirect effects only
Reepham Stream (western branch)	Bullhead	Upstream of the habitats and species study area	Crossed using trenched techniques – potential direct effects
Reepham Stream (eastern branch)	Bullhead	Upstream of the habitats and species study area	Crossed using trenched techniques – potential direct effects
Booton Watercourse	Brown trout	Upstream and downstream of the habitats and species study area	Crossed using trenched techniques – potential direct effects
River Bure	Bullhead Brown Trout Brook lamprey	Upstream and downstream of the habitats and species study area	Avoided through trenchless crossing techniques – indirect effects only
King's Beck	Brown Trout Brook lamprey	Upstream and downstream of the habitats and species study area	Avoided through trenchless crossing techniques – indirect effects only

676. Potential direct effects upon bullhead and brown trout may occur at the following watercourses:

- Reepham Stream (western branch);
- Reepham Stream (eastern branch); and
- Booton Watercourse.

677. These works may potentially give rise to loss of spawning grounds for brown trout and bullhead during the construction phase during trenching works at these three locations. Works will take place over one week at each of these locations, so the potential effect will be short term and localised, representing a very small proportion of the potential spawning period for either species (November to February for brown trout and February to June for bullhead (Wild Trout Trust, 2018; Tomlinson & Perrow, 2003). The magnitude of the effect is therefore considered to be low.

678. Potential indirect effects upon these fish species may occur at the eight watercourses listed in Table 22.25. These include risk of pollutant release and increased sediment runoff from works adjacent to these watercourses. These effects are described in full in section 22.7.5.1.

Impact without mitigation

679. A potential change to notable fish species is only anticipated as part of the onshore cable route, where trenching works could result in an effect of low magnitude upon a high importance receptor. A resultant impact of **moderate adverse** significance is anticipated upon these receptors.

Mitigation

680. Prior to construction, a survey of the three locations outlined above will be undertaken to assess the suitability of the substrate at these locations for supporting spawning bullhead and brown trout.
681. If suitable habitat for these species is identified, appropriate mitigation (such as ecological supervision during works, timing of works to avoid sensitive seasons or micro-siting) would be agreed with Natural England post-consent.
682. The mitigation set out in section 22.7.5.1 will be applied to all works adjacent to the watercourses in Table 22.25 in order to mitigate any potential direct and indirect effects.

Impact following mitigation

683. Following implementation of these mitigation measures, the risk of direct and indirect effects upon notable fish species, is reduced to a negligible magnitude of effect. As a consequence, a residual impact of **minor adverse** significance is expected to remain.

22.7.5.17.3 Scenario 1

Onshore cable route

684. Under Scenario 1, if notable fish species are found (during the Norfolk Boreas pre-construction habitat assessment) to be spawning at the Reepham Stream (eastern and western branches) and the Booton watercourse within the onshore cable route, then these areas will be potentially disturbed for a second time when the running track is reinstated across these watercourses during the cable pulling works. In this instance, these works may potentially give rise to loss of spawning grounds for brown trout and bullhead during the construction phase for a second time at these three locations. Works will take place over one week at each of these locations, so the potential effect will be short term and localised. The magnitude of the effect is therefore considered to be low.

Impact without mitigation

685. A potential change to notable fish species is only anticipated as part of the onshore cable route, where installation of the running track could result in an effect of low magnitude upon a high importance receptor, and an impact of **moderate adverse** significance is anticipated upon these receptors.

Mitigation

686. The mitigation set out under Scenario 2 (see section 22.7.5.17.2) would be adhered to during the construction phase works.

Impact following mitigation

687. Following implementation of these mitigation measures, the risk of direct and indirect effects upon notable fish species, is reduced to a negligible magnitude. As a consequence, a residual impact of **minor adverse** significance is expected to remain.

22.7.5.18 Impact 18: Protected flora

22.7.5.18.1 Scenario 1 and Scenario 2

Landfall, onshore project substation, National Grid substation extension and overhead line modifications

688. There are no suitable habitats within or adjacent to the landfall, onshore project substation or National Grid substation extension and overhead line modifications which are suitable to support the species which comprise the River Wensum SAC qualifying feature '*watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation*'. As such there will be no change upon this receptor under either scenario.

Onshore cable route

689. The River Wensum will be crossed using trenchless crossing techniques (e.g. HDD) as part of embedded mitigation to avoid potential impacts at these crossing points. The species which comprise the River Wensum SAC qualifying feature '*watercourses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation*' may also be present in the marginal vegetation within watercourses within the River Wensum floodplain. The River Wensum floodplain was therefore surveyed as part of the 2017 and 2018 botanical surveys of these habitats. These species were not found to be present (see Appendix 22.7). As a consequence, no change upon this receptor is anticipated under either scenario. The HRA Report (document reference 5.3) submitted with the final DCO application provides full details of the potential effects upon the River Wensum SAC.

Impact without mitigation

690. As notable flora species have not been identified within the habitats and species study area, **no impact** upon these species is anticipated under either scenario.

Mitigation

691. As there is no impact on this receptor, no mitigation is proposed. Good construction practice measures will be used when working within the River Wensum floodplain, and these are described in section 22.7.5.1.

22.7.5.19 Impact 19: Invasive non-native species

22.7.5.19.1 Scenario 1 and Scenario 2

Landfall

692. There are no invasive non-native species recorded within or adjacent to the landfall. As the construction will involve bringing in plant and equipment to the habitats and species study area, including plant which will be used in other areas of the onshore project area where presence of invasive species is known to occur, there is a risk of releasing non-native species into the habitats and species study area during the construction phase. The risk of introducing non-native species over the long term is anticipated to have an effect of medium magnitude.

Onshore cable route

693. The invasive species signal crayfish have been recorded on the River Wensum and River Bure, and the invasive American mink has also been recorded on the River Wensum. There is no risk of releasing American mink into other locations, as this species will not be transferred by construction plant. The River Wensum and River Bure will be crossed using trenchless crossing techniques (e.g. HDD) as embedded mitigation, and as such there is no risk of releasing signal crayfish into other areas of the habitats and species study area at these locations. The following two watercourses have also been identified within the study area as supporting signal crayfish (see Chapter 20 Water Resources and Flood Risk for locations of these watercourses):

- Blackwater drain; and
- Reepham Stream.

694. These watercourses are proposed to be crossed using trenching methods. As such any plant working in these watercourses will be at risk of transporting and releasing signal crayfish between areas of the cable route, or carrying or transferring crayfish plague. The risk of introducing signal crayfish or crayfish plague to other areas of the cable route over the long term is anticipated to have an effect of medium magnitude.

695. There is a risk of the construction phase works causing the Japanese knotweed located at TN291 (see Figure 22.5) to be spread to other areas of the habitats and species study area during construction. The risk of introducing non-native species over the long term is assessed as an effect of medium magnitude.

Unsurveyed areas

696. Approximately 35% of the onshore cable route has been surveyed for invasive non-native species, so the presence of further invasive non-native species cannot be ruled out completely at this stage. If invasive species are found in these areas, the risk of spreading further non-native invasive species to other areas of the habitats and species study area during construction exists, which will also represent an effect of medium magnitude.

Onshore project substation

697. There are no invasive non-native species recorded within or adjacent to the onshore project substation. As the construction works will involve bringing in plant and equipment to the habitats and species study area, including plant which will be used in other areas of the onshore project area where presence of invasive species is known to occur, there is a risk of releasing non-native species into the habitats and species study area during the construction phase. The risk of introducing non-native species over the long term is assessed as an effect of medium magnitude.

National Grid substation extension and overhead line modifications

698. There are no invasive non-native species recorded within or adjacent to the National Grid substation extensions and overhead line modifications. As the construction works will involve bringing in plant and equipment to the habitats and species study area, including plant which will be used in other areas of the onshore project area where presence of invasive species is known to occur, there is a risk of releasing non-native species into the habitats and species study area during the construction phase. The risk of introducing non-native species over the long term is assessed as an effect of medium magnitude.

Impact without mitigation

699. During construction works within the onshore project area, there is a risk of introducing non-native species which is anticipated to have an effect of medium magnitude.
700. Without mitigation, the greatest effect arising from the project is of medium magnitude on a medium importance receptor, and this is anticipated to result in an impact of at worst **moderate adverse** significance.

Unsurveyed areas

701. If invasive species are found in unsurveyed areas, the risk of spreading non-native invasive species during construction exists, which will represent an effect of medium magnitude on a receptor of medium importance, resulting in an impact of **moderate adverse** significance.

Mitigation

702. The following mitigation will be undertaken:

- The unsurveyed areas will be surveyed as part of the post-consent survey effort, and the locations of all stands of invasive species will be recorded and their extent mapped.

703. Prior to construction, an Invasive Species Management Plan will be developed. This plan will be agreed with the Environment Agency and Natural England in advance of construction and would include the following:

- A plan of all invasive species locations and extents;
- A protocol for removing the Japanese knotweed stand east of the River Bure and for managing the waste generated;
- Good site practice measures for managing the spread of invasive species;
- Good site practice measures for managing the spread of invasive species during works at watercourses;
- A requirement for an Ecological Clerk of Works (ECoW) and details of their responsibilities with respect to non-native invasive species.

704. The Invasive Species Management Plan will form part of the project CoCP. Further details of the content of which will go into the Invasive Species Management Plan will be set out in the outline CoCP (document reference 8.1) provided as part of the DCO application.

Impact following mitigation

705. Following implementation of these mitigation measures, the risk of spreading invasive species, is reduced to a low magnitude of effect. As a consequence, a residual impact of **minor adverse** significance is expected to remain.

Unsurveyed areas

706. As above, following implementation of these mitigation measures, the risk of spreading invasive species, is reduced to a low magnitude effect. As a consequence, a residual impact of **minor adverse** significance is expected to remain.

22.7.6 Potential Impacts during Operation

707. Potential operational impacts are limited to maintenance activities at the onshore project substation and National Grid substation extension, as no regular works are

required on the onshore cable route. As a result, the impacts during operation are substantially less than those identified during construction.

22.7.6.1 Impact 1: Disturbance to habitats and species from maintenance activities

22.7.6.1.1 Scenario 1 and Scenario 2

Onshore project substation

708. Routine maintenance of the onshore project substation will require one visit per week, during normal construction hours. As a consequence, disturbance from noise and human presence (above general operational movements on and off site) is predicted to be of negligible magnitude and to only affect receptors in the immediate vicinity of the onshore project substation under either scenario.

National Grid substation extension

709. Routine maintenance of the National Grid substation extension will require one visit per week, during normal construction hours. As a consequence, disturbance from noise and human presence (above general operational movements on and off site) is predicted to be of negligible magnitude and to only affect receptors in the immediate vicinity of the National Grid substation extension under either scenario.

Impact without mitigation

710. Without mitigation, the greatest effect arising from the project is of negligible magnitude, on at worst, high importance receptors. This will result in an impact of at worst a **minor adverse** significance.

Mitigation

711. No mitigation is proposed.

22.7.6.2 Impact 2: Disturbance to fauna from operational lighting and noise

22.7.6.2.1 Scenario 1 and Scenario 2

Onshore project substation

712. Operational lighting at the onshore project substation under either scenario will be provided for operation and maintenance activities only, and under normal conditions it will not be lit. As a consequence, disturbance from lighting (above general operational movements on and off site) is predicted to be of a negligible magnitude of effect and to only affect receptors in the immediate vicinity of the onshore project substation.

National Grid substation extension

713. Operational lighting at the National Grid substation extension under either scenario will be provided for operation and maintenance activities only, and under normal conditions it will not be lit. As a consequence, disturbance from lighting (above general operational movements on and off site) is predicted to be of a negligible

magnitude of effect and to only affect receptors in the immediate vicinity of the National Grid substation extension.

Impact without mitigation

714. Without mitigation, the greatest effect arising from the project is of negligible magnitude of effect, on at worst high importance receptors. This is predicted to result in an impact of at worst **minor adverse** significance.

Mitigation

715. A lighting scheme will be designed for the final design for the permanent infrastructure, which will include measures to minimise light spill and be designed in line with the 'Bats and Artificial Lighting in the UK' guidance (BCT and ILP, 2018).

Impact following mitigation

716. Following implementation of these mitigation measures, the magnitude of effect will remain negligible. As a consequence, a residual impact of **minor adverse** significance is expected to remain..

22.7.7 Potential Impacts during Decommissioning

717. This section describes the potential impacts of the decommissioning of the onshore infrastructure with regards to impacts on onshore ecology. The potential decommissioning impacts would be the same under Scenario 1 and Scenario 2, therefore have not been assessed separately. Further details are provided in Chapter 5 Project Description.

718. No decision has been made regarding the final decommissioning policy for the onshore cables, as it is recognised that industry best practice, rules and legislation change over time. It is likely the cables would be pulled through the ducts and removed, with the ducts themselves sealed and capped and left in-situ.

719. In relation to the onshore project substation, the programme for decommissioning is expected to be similar in duration to the construction phase. The detailed activities and methodology would be determined later within the project lifetime, but are expected to include:

- Dismantling and removal of outside electrical equipment from outside of the onshore project substation buildings;
- Removal of cabling from site;
- Dismantling and removal of electrical equipment from within the onshore project substation buildings;
- Removal of onshore project substation building and minor services equipment;
- Demolition of the support buildings and removal of fencing;
- Landscaping and reinstatement of the site (including land drainage); and

- Removal of areas of hard standing.
720. Whilst details regarding the decommissioning of the onshore project substation are currently unknown, considering the worst case which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be no worse than those during construction.
721. The decommissioning methodology would need to be finalised nearer to the end of the lifetime of the project so as to be in line with current guidance, policy and legislation at that point. Any such methodology and associated mitigation would be agreed with the relevant authorities and statutory consultees. The decommissioning works could be subject to a separate licencing and consenting approach.

22.8 Cumulative Impacts

722. The assessment of cumulative impact has been undertaken here as a two stage process. Firstly, all the impacts from previous sections have been assessed for potential to act cumulatively with other projects. A summary of this assessment is set out in Table 22.26.

Table 22.26 Potential cumulative impacts

Impact		Potential for cumulative impact	Rationale
Construction			
1	Statutory designated sites	Yes	Impacts to interest features of designated sites may be exacerbated by other projects
2	Non-statutory designated sites	Yes	Impacts to interest features of designated sites may be exacerbated by other projects
3	Arable land	Yes	Loss of habitat due to other projects may increase the cumulative loss of habitat within the county
4	Woodland, trees and scrub	Yes	Loss of habitat due to other projects may increase the cumulative loss of habitat within the county
5	Hedgerows	Yes	Loss of habitat due to other projects may increase the cumulative loss of habitat within the county
6	Grassland	Yes	Loss of habitat due to other projects may increase the cumulative loss of habitat within the county
7	Coastal habitats	No	No impacts have been identified in section 22.7.
8	Watercourses and ponds	Yes	Loss of habitat due to other projects may increase the cumulative loss of habitat within the county
9	Badgers	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
10	Bats	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county

Impact		Potential for cumulative impact	Rationale
11	Water vole	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
12	Otter	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
13	Great crested newts	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
14	Reptiles	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
15	White-clawed crayfish	No	No impacts have been identified in section 22.7.
16	Other invertebrates	No	No impacts have been identified in section 22.7.
17	Fish	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
18	Protected flora	No	No impacts have been identified in section 22.7.
19	Invasive non-native species	Yes	Other projects may exacerbate the risk from invasive species within the county
Operation			
1	Habitat and species during maintenance	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
2	Fauna during operational lighting and noise	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
Decommissioning			
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.			

723. The second stage of the CIA is an assessment of whether there is spatial or temporal overlap between the extent of potential effects of the onshore project area and the potential effects of other projects scoped into the CIA upon the same receptors. To identify whether this may occur, the potential nature and extent of effects arising from all projects scoped into the CIA have been identified and any overlaps between these and the effects identified in section 22.7 have also been identified. Where there is an overlap, an assessment of the cumulative magnitude of effect is provided.
724. Projects identified for potential cumulative impacts that were agreed as part of the Norfolk Boreas PEIR consultation. These projects, as well as any relevant development applications submitted since this consultation have been considered and their anticipated potential for cumulative impact are detailed in Table 22.27.

Table 22.27 Summary of projects considered for the CIA in relation to onshore ecology

Project	Status	Development period	¹⁹ Distance from onshore project area (km)	Project definition	Project data status	Included in CIA	Rationale
National Infrastructure Planning							
Norfolk Vanguard Offshore Wind Farm	Application submitted	Expected construction 2020 to 2025	0 – projects are co-located	Full ES available: https://infrastructure.planninginspectorate.gov.uk/projects/eastern/norfolk-vanguard/?ipcsection=docs	High	Yes	Overlapping proposed project boundaries may result in impacts of a direct and / or indirect nature during construction and operation.
Hornsea Project Three Offshore Wind Farm	Application submitted	Expected construction start date 2021. Duration 6 to 10 years dependent on phasing.	0 – cable intersects project 32km between substation locations	Full ES available: https://infrastructure.planninginspectorate.gov.uk/projects/eastern/hornsea-project-three-offshore-wind-farm/?ipcsection=docs	High	Yes	Overlapping proposed project boundaries at Salle Park may result in impacts of a direct and / or indirect nature during construction and operation
Dudgeon Offshore Wind Farm	Commissioned	Constructed	0	http://dudgeonoffshorewind.co.uk/	High	Yes	Already constructed
A47 corridor improvement programme – North Tuddenham to Easton	Pre-application (application due 2020)	Start works April 2021 Open May 2023	26.7	https://highwaysengland.co.uk/projects/a47-north-tuddenham-to-easton-improvement-scheme/	Medium	No	Development is located 2.5km from the project boundary and is therefore outside of the study areas considered within this chapter. No cumulative impacts are anticipated.

¹⁹ Shortest distance between the considered project and Norfolk Vanguard – unless specified otherwise.

Project	Status	Development period	¹⁹ Distance from onshore project area (km)	Project definition	Project data status	Included in CIA	Rationale
A47 corridor improvement programme – A47 Blofield to North Burlingham	Pre-application (application due 2019)	Start works 2021 Open 2022	25	https://highwaysengland.co.uk/projects/a47-blofield-to-north-burlingham/	Medium	No	Development is located 25km from the project boundary and is therefore out of the study areas for onshore ecology. No cumulative impacts are anticipated.
A47 corridor improvement programme – A47 / A11 Thickthorn Junction	Pre-application (application due 2019)	Start works 2021 Open 2023	18	https://highwaysengland.co.uk/projects/a47-thickthorn-junction/	Medium	No	Development is located 18km from the project boundary and is therefore outside the study areas for onshore ecology. No cumulative impacts are anticipated.
Norwich Western Link	Pre-application	Expected construction start late 2022	2.8	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/norwich/norwich-western-link	Medium	No	Development is located 2.8km from the project boundary and is therefore outside of the study areas considered within this chapter. No cumulative impacts are anticipated.
Third River Crossing (Great Yarmouth)	Pre-application (application due 2019)	Expected construction start in late 2020 Open early 2023	28	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/great-yarmouth/third-river-crossing	Medium	No	Development is located 18km from the project boundary and is therefore outside the study area(s) identified for onshore ecology. No cumulative impacts are anticipated.

Project	Status	Development period	¹⁹ Distance from onshore project area (km)	Project definition	Project data status	Included in CIA	Rationale
King's Lynn B Power Station amendments	Approved	Expected construction start 2018 to 2022	28	https://www.kingslynnbccgt.co.uk/	High	No	Development is located 18km from the project boundary and is therefore outside the study area(s) identified for onshore ecology. No cumulative impacts are anticipated.
North Norfolk District Council							
PF/17/1951 Erection of 43 dwellings and new access with associated landscaping, highways and external works	Approved	Anticipated Q2 2018	0.7	Application available: https://idoxpa.north-norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=_NNORF_DCAPR_92323	High	No	Development is located 0.7km from the project boundary and is therefore within the designated sites study area, but is more than 5km from the internationally designated sites and 2km from the nationally designated sites considered in this chapter. No cumulative impacts are anticipated.
Bacton and Walcott Coastal Management Scheme	Submitted	Expected Construction start date Spring 2019	1.0	Public information leaflets available: https://www.north-norfolk.gov.uk/media/3371/bacton-to-walcott-public-information-booklet-july-2017.pdf	Medium	No	Coastal protection scheme is located 1km from the project boundary and 2.5km from the landfall location. The scheme is restricted to works to coastal habitats, which will be avoided for Norfolk Boreas through the use of trenchless techniques at the landfall. No cumulative impacts are anticipated.
Coastal defence/protection works, Happisburgh PF/18/0751	Approved	Coastal protection over 10 year duration from August 2018	0.12	https://idoxpa.north-norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=	Medium	No	Coastal protection scheme is located 0.1km from the project boundary. However the scheme is restricted to works to coastal habitats, which will be avoided for Norfolk Boreas through

Project	Status	Development period	¹⁹ Distance from onshore project area (km)	Project definition	Project data status	Included in CIA	Rationale
				summary&keyVal=_NNORF_DCAPR_93543			the use of trenchless techniques at the landfall. No cumulative impacts are anticipated.
Breckland Council							
Erection of 85 Dwellings with Associated Open Space 3PL/2018/1246/F	Awaiting Decision	Application received 04/10/18.	1.26	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2018/1246/F&from=planningSearch	Medium	No	Development is located 1.4km from the project boundary and is therefore within the designated sites study area, but is more 600m from the nearest designated site considered in this chapter (River Wensum). No cumulative impacts are anticipated.
Residential development of 40 No. units comprising a mix of housing types, accommodating open space and appropriate associated infrastructure with vehicle access via Hall Road 3PL/2018/0993/F	Approved	Application approved 11/02/19. Construction must begin within 2 years.	1.42	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2018/0993/F&from=planningSearch	Medium	No	Development is located 1.3km from the project boundary and is therefore within the designated sites study area, but is more than 2km from the designated sites considered in this chapter. No cumulative impacts are anticipated.

725. Under Scenario 2 Norfolk Vanguard would not proceed to construction, as such there would be no cumulative impacts and therefore this scenario is not considered as part of the CIA.
726. Under Scenario 1 the installation of ducts for the onshore cable route for Norfolk Boreas will be conducted as part of Norfolk Vanguard construction. Therefore, the elements of Norfolk Vanguard that are considered in the CIA are the Norfolk Vanguard cable pulling and onshore project substation (including the National Grid substation extension, any landscaping or planting, and the onshore 400kV cable route).
727. In summary, the following projects will be assessed for potential direct cumulative impacts (where relevant):

Scenario 1

- Norfolk Vanguard Offshore Wind Farm;
- Dudgeon Offshore Wind Farm;
- Hornsea Project Three Offshore Wind Farm.

Scenario 2

- Dudgeon Offshore Wind Farm;
- Hornsea Project Three Offshore Wind Farm.

728. To avoid confusion between different projects, the Norfolk Boreas Offshore Wind Farm, previously referred to as ‘the project’, is referred to as ‘Norfolk Boreas’ within this section.
729. The cumulative impact summary presented below presents both Scenario 1 and Scenario 2 together where the cumulative impact is the same. Where the significance of the cumulative impact is different for Scenarios 1 and 2, this is set out below.

22.8.1 Cumulative Impacts during Construction

22.8.1.1 Cumulative Impact 1: Statutory designated sites

22.8.1.1.1 Scenario 1

730. The Norfolk Boreas onshore project substation is located adjacent to the Norfolk Vanguard onshore project substation. The onshore project substation is not located within 2km of a statutory designated site. The onshore project substation is located within 500m of ancient woodlands potentially affected by Norfolk Vanguard, and therefore has the potential to give rise to cumulative effects by extending the period over which these ancient woodlands will be subject to indirect effects. As this involves only an extension in a duration of effect which is already long term, this will

not change the significance of the impact described above. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.1.2 Scenario 1 and 2

731. Of the statutory designated sites considered within section 22.7, Booton Common SSSI (a component of Norfolk Valley Fens SAC) is located both within 2km of the cable route (although outside the habitats and species study area) and approximately 500m west of Hornsea Project Three. No change is anticipated upon Booton Common SSSI arising from Norfolk Boreas alone, therefore cumulative effects are not anticipated. The River Wensum SAC and SSSI is also crossed by both the onshore project area and Hornsea Project Three. The locations at which these two projects cross the River Wensum are approximately 10km apart. As trenchless techniques will be used at this site for Norfolk Boreas, cumulative effects are unlikely to occur. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).
732. No other statutory designated sites fall within 2km of the project and within 2km of any of the projects listed in Table 22.27. No other ancient woodlands fall within 500m of the project and within 500m of any of the projects listed in Table 22.27. As such, no further cumulative effects upon other statutory designated sites are anticipated to arise, and cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).
733. There is the potential for air quality emissions arising from increase in vehicle movements associated with Norfolk Boreas and Hornsea Project Three to act cumulatively. Chapter 26 Air Quality considered the potential impacts of increases in nutrient nitrogen deposition arising from increases in road traffic during the construction phase of the project in combination with Hornsea Project Three upon sensitive habitats and species which are qualifying features of SAC, SPA and SSSIs located within 200m of the road transport network (see Figure 26.3 and Table 26.20 Chapter 26 Air Quality). This assessment of the cumulative air quality impacts arising from increases in road traffic on the road transport network has been undertaken following the latest IAQM guidance on assessment of impacts on air quality arising from road traffic emissions (IAQM, 2014).
734. There are 13 statutory designated sites for nature conservation which have been scoped into the construction vehicle emissions study area (see Figure 26.3 and Table 26.20 Chapter 26 Air Quality). Of these, Chapter 26 Air Quality predicted nutrient nitrogen deposition of >1% of the critical load to occur at two of the sites under Scenario 2. These sites are summarised in Table 22.28 below.

Table 22.28 Statutory designated sites subject to >1% of the relevant nutrient nitrogen deposition

Statutory Designated site	Nutrient nitrogen deposition sensitive habitat or features present within the site	Lowest Critical Load (kgN.ha ⁻¹ .y ⁻¹)	Suitable habitat present within 50m of road network?	% of critical load
Felbrigg Woods SSSI	Broadleaved, mixed and yew woodland	10	Yes	2%
River Wensum SAC / SSSI	Rich Fens	15	No	2%

735. At Felbrigg Woods SSSI, the only habitat type within the study area is broadleaved woodland. At the critical load (10 kgN.ha⁻¹.y⁻¹) for broadleaved woodlands, nutrient nitrogen deposition is anticipated to result in changes in soil processes, nutrient imbalance, altered composition mycorrhiza and ground vegetation (Bobbink *et al.*, 2011). As the project is anticipated to result in a temporary increase in nutrient nitrogen deposition at only 2% of the critical load (0.15 kgN.ha⁻¹.y⁻¹) for areas immediately adjacent to the road network only (woodland provide a rough surface which will ensure that nutrient nitrogen deposition rapidly drops off with distance from source) for the duration of the construction period, the localised, temporary effect is not anticipated to change the structure and function of the habitat and the is anticipated to be of negligible magnitude.
736. At the River Wensum SAC/SSSI, no nitrogen sensitive rich fens habitat is present within 200m of the road network. As such, no change is anticipated.
737. An effect of negligible magnitude upon a high importance receptor gives rise to an impact of **minor adverse** significance. As such effects are of the same significance set out in section 22.7.5.1.

22.8.1.2 Cumulative Impact 2: Non-statutory designated sites

22.8.1.2.1 Scenario 1

738. The Norfolk Boreas substation is located adjacent to the Norfolk Vanguard onshore project substation. The onshore project substation is located over 200m from Necton Wood CWS. There is the potential therefore for cumulative effects by extending the period over which this CWS will be subject to indirect effects. As this involves only an extension in a duration of effect which is already long term, this will not change the significance of the impact described above. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.2.2 Scenario 1 and 2

739. Of the non-statutory designated sites considered within section 22.7 five (Necton Wood, Marriott's Way, Salle Common & Adjacent Land, Salle Park, Reepham

Meadows) are located within 2km of both the project and projects listed in Table 22.27. Of these, only one (Marriott's Way) is located within 100m of the project and projects listed in Table 22.27. As this site will be crossed by the Norfolk Boreas project using trenchless techniques, there will be no cumulative effects upon this site. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.3 Cumulative Impact 3: Arable land

22.8.1.3.1 Scenario 1

740. The Norfolk Vanguard onshore project substation will result in the additional permanent loss of 7.5ha, plus temporary loss of 2ha of arable land. The arable habitats within the Norfolk Boreas onshore project substation have been identified as habitats of negligible importance during the 2017 and 2018 Extended Phase 1 Habitat Surveys. As such negligible cumulative effects are anticipated to arise as a result of these projects and cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.3.2 Scenario 1 and 2

741. Cereal field margin habitat, a UKHPI and habitat of high importance is likely to be lost due to Hornsea Project Three simultaneously with Norfolk Boreas. The area of cereal field margin lost due to Hornsea Project Three has not been identified in the ES, but the scale of the impacts is anticipated to be similar to Norfolk Boreas and as such is of a small scale in the context of the 750ha of field margins within Norfolk. As such, the magnitude of the cumulative effect is assessed as negligible and therefore cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.4 Cumulative Impact 4: Woodland, trees and scrub

742. No woodland, tree or scrub habitats are located within 50m of both Norfolk Vanguard or Hornsea Project Three and the Norfolk Boreas project. As such no cumulative effect is experienced and the effects are of the same significance set out in section 22.7 (**no impact** for Scenario 1; **negligible** for Scenario 2).

22.8.1.5 Cumulative Impact 5: Hedgerows

22.8.1.5.1 Scenario 1

743. The Norfolk Boreas onshore project substation will result in the additional loss of 270m of species-poor hedgerow. Hedgerows are a UKHPI and habitat of high importance. The scale of this loss is in proportion to the habitat loss for Norfolk Vanguard, and as such cumulative effects are of the same significance set out in section 22.7 (**minor adverse** for Scenario 1).

22.8.1.5.2 Scenario 1 and 2

744. Hedgerow habitat is likely to be lost due to Hornsea Project Three simultaneously with Norfolk Boreas. The area of hedgerow habitat lost due to Hornsea Project Three within 50m of Norfolk Boreas restricted to the loss of 6m of hedgerow in one location, and is therefore small in proportion to the up to 2.1km of hedgerow anticipated to be lost as a result of Norfolk Boreas. As such, cumulative effects are of the same significance set out in section 22.7 (**moderate adverse**).

22.8.1.6 Cumulative Impact 6: Grassland

745. No grassland habitats are located within 50m of both Norfolk Vanguard or Hornsea Project Three and Norfolk Boreas. As such no cumulative effect is experienced and effects are of the same significance set out in section 22.7 (**no impact** for Scenario 1; **minor adverse** for Scenario 2).

22.8.1.7 Cumulative Impact 7: Coastal Habitats

746. As these habitats are not present within the onshore project area; no impact as a result of Norfolk Boreas is anticipated, therefore cumulative effects are of the same significance set out in section 22.7 (**no impact**).

22.8.1.8 Cumulative Impact 8: Watercourses and ponds

747. Two watercourses crossed by the onshore project area, the River Wensum and the River Bure, are also crossed by Hornsea Project Three. These watercourses will be crossed using trenchless crossing techniques (e.g. HDD) by Norfolk Boreas and by Hornsea Project Three as part of embedded mitigation, and as such there will no cumulative effect on these receptors and therefore effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.9 Cumulative Impact 9: Badgers

22.8.1.9.1 Scenario 1

748. Badgers have not been recorded within the Norfolk Boreas onshore project substation area and as such there is no cumulative effect upon this receptor. As such, effects are of the same significance set out in section 22.7 (**negligible** for Scenario 1).

22.8.1.9.2 Scenario 1 and 2

749. Badgers have not been recorded in the land within Hornsea Project Three and within 50m of the onshore project area. As such cumulative effect is experienced, and therefore effects are of the same significance set out in section 22.7 (**negligible** for Scenario 1; **minor adverse** for Scenario 2 and unsurveyed areas).

22.8.1.10 Cumulative Impact 10: Bats

22.8.1.10.1 Scenario 1

750. The Norfolk Boreas onshore project substation will result in the additional loss of 270m of hedgerows used for bat commuting and foraging habitat. This loss is of a commensurate scale to the habitat lost under Norfolk Vanguard and as such the magnitude of effect is the same. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse** for Scenario 1).

22.8.1.10.2 Scenario 1 and 2

751. Two hedgerows which fall within 50m of both Hornsea Project Three and Norfolk Boreas have been identified as suitable commuting or foraging features for bats. Hornsea Project Three will cross these three hedgerows using trenchless crossing techniques, and will result in a maximum removal of 6m of hedgerow at either location. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse** for Scenario 1; **moderate adverse** for Scenario 2 and unsurveyed areas).

22.8.1.11 Cumulative Impact 11: Water voles

22.8.1.11.1 Scenario 1

752. The Norfolk Boreas onshore project substation is located adjacent to the Norfolk Vanguard onshore project substation and is not located within or adjacent to any suitable water vole habitat. As such no cumulative effect is experienced, and therefore effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.11.2 Scenario 1 and 2

753. No watercourses suitable for water vole are located within 50m of both Hornsea Project Three and the Norfolk Boreas project. As such no cumulative effect is experienced, and therefore cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.12 Cumulative Impact 12: Otters

22.8.1.12.1 Scenario 1

754. No habitats suitable for otter are located within 50m of both Norfolk Vanguard or Hornsea Project Three and Norfolk Boreas. As such no cumulative effect is experienced, and therefore effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.12.2 Scenario 1 and 2

755. Two watercourses which contain habitats suitable for otter crossed by the onshore project area, the River Wensum and the River Bure, are also crossed by Hornsea Project Three. These watercourses will be crossed using trenchless crossing techniques (e.g. HDD) by Norfolk Boreas and Hornsea Project Three as part of embedded mitigation, and as such there will be no cumulative effects upon these receptors. As such, effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.13 Cumulative Impact 13: Great Crested Newts

22.8.1.13.1 Scenario 1

756. Great crested newts are present within 500m of the Norfolk Vanguard onshore project substation. The Norfolk Vanguard onshore project substation will result in the additional loss of 270m of hedgerow foraging habitat. This is a likely good foraging habitat for great crested newts breeding at water body TF9010-50. Given the paucity of other good foraging habitat nearby, these features may provide important habitat for great crested newts. This does not raise the magnitude of the effects, which remains low following the mitigation set out in section 22.7 and which therefore results in a cumulative effect of the same significance set out in section 22.7 (**minor adverse** for Scenario 1).

22.8.1.13.2 Scenario 1 and 2

757. There are no suitable water bodies for supporting great crested newts within 250m of the onshore project area and within Hornsea Project Three. Therefore, no change is anticipated upon this receptor due to this project. As such, no cumulative effect is experienced and effects are the same significance set out in section 22.7 (**minor adverse** for Scenario 1 and 2; **minor adverse** for unsurveyed areas).

22.8.1.14 Cumulative Impact 14: Reptiles

758. No habitats suitable for common reptiles are located within 50m of both Norfolk Vanguard or Hornsea Project Three and Norfolk Boreas. As such no cumulative effect is experienced, and therefore effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.15 Cumulative Impact 15: White-clawed crayfish

759. As no change upon these species is anticipated to arise as a result of Norfolk Boreas, no cumulative effect is experienced; the effects are of the same significance as set out in section 22.7 (**no impact**).

22.8.1.16 Cumulative Impact 16: Other invertebrates

760. As no change upon these species is anticipated to arise as a result of Norfolk Boreas, no cumulative effect is experienced; the effects are of the same significance as set out in section 22.7 (**no impact**).

22.8.1.17 Cumulative Impact 17: Fish

761. There are no notable fish species recorded within the Norfolk Boreas and Norfolk Vanguard landfall works and onshore project substation areas. As such no cumulative effect is experienced, and therefore cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

762. One watercourse which supports brown trout, bullhead and brook lamprey, the River Wensum, is also crossed by both the onshore project area and Hornsea Project Three. The locations at which these two projects cross the River Wensum are approximately 10km apart. As trenchless techniques will be used at this site for Norfolk Boreas and for Hornsea Project Three, cumulative effects are unlikely to occur. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.1.18 Cumulative Impact 18: Protected flora

763. As no change upon these species is anticipated to arise as a result of Norfolk Boreas, no cumulative effect is experienced; the effects are of the same significance as set out in section 22.7 (**no impact**).

22.8.1.19 Cumulative Impact 19: Invasive non-native species

764. There are no invasive non-native species recorded within or adjacent to the areas which lie within both Norfolk Boreas and projects listed in Table 22.27. However, as the construction of the projects listed in Table 22.27 will involve bringing in plant and equipment to the habitats and species study area, including plant which will be used in other areas of the country, there is a risk of releasing non-native species along the full extent of the construction phase works for Hornsea Project Three (**minor adverse**).

765. With the mitigation measures set out in section 22.7 adhered to during construction of Norfolk Boreas, this risk is reduced and the magnitude of effect remains low. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.2 Cumulative Impacts during Operation

22.8.2.1 Cumulative Impact 1: Disturbance to habitats and species from maintenance activities

766. The Norfolk Vanguard and Dudgeon Offshore Wind Farm are anticipated to have similar maintenance requirements as Norfolk Boreas (i.e. one visit per week, during

normal construction hours), all of which are small in scale. As a consequence, disturbance from noise and human presence (above general operational movements on and off site) is predicted to be of negligible cumulative magnitude and only affect receptors in the immediate vicinity of the onshore project substation. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.2.2 Cumulative Impact 2: Disturbance to fauna from operational lighting and noise

767. Operational lighting from the Dudgeon Offshore Wind Farm onshore substation is subject to mitigation measures as part of its consent conditions, including screening to minimise the levels of light pollution arising from the site. Operational lighting at the Norfolk Vanguard onshore project substation will be provided for operations and maintenance activities only, and under normal conditions it would not be lit. As a consequence, disturbance from lighting (above general operational movements on and off site) is predicted to be of negligible cumulative magnitude and only affect receptors in the immediate vicinity of the onshore project substation. As such, cumulative effects are of the same significance set out in section 22.7 (**minor adverse**).

22.8.3 Cumulative Impacts during Decommissioning

768. Decommissioning of Norfolk Vanguard and Hornsea Project Three may potentially take place at the same time as Norfolk Boreas. The detail and scope of the decommissioning works for Norfolk Boreas will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.

22.9 Inter-relationships

769. Table 22.29 lists out the inter-relationships between this chapter and other chapters within this ES.

Table 22.29 Chapter topic inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter	Rationale
Potential impacts to watercourses and how this will affect the species they support	Chapter 20 Water Resources and Flood Risk	Section 22.7.5.1, 22.7.5.8, 22.7.5.11, 22.7.5.12, 22.7.5.15, 22.7.5.17 and 22.7.5.19.	Works at watercourses may influence ecological species and habitats
Habitats which support onshore ornithology	Chapter 23 Onshore Ornithology	Section 22.7.5.1, 22.7.5.3, 22.7.5.4, 22.7.5.5, 22.7.5.6.	Onshore ornithology may share habitats of

Topic and description	Related Chapter	Where addressed in this Chapter	Rationale
			importance with onshore ecology
Noise disturbance on protected species	Chapter 25 Noise and Vibration	Section 22.7.5.1, 22.7.5.2 and 22.7.5.9 - 22.7.5.12.	Noisy activities associated with construction may disturb protected species
Dust impacts to habitats and species	Chapter 26 Air Quality	Section 22.7.5 (all sections)	Changes in dust levels in the air may affect ecological habitats and species
Lighting impacts to protected species Landscape mitigation planting	Chapter 29 Landscape and Visual Impact Assessment	Section 22.7.5 (all sections)	Construction and maintenance lighting (covered in Chapter 29) may cause disturbance to protected species Mitigation planting at the substation has been designed to provide biodiversity benefit

22.10 Interactions

770. The impacts identified and assessed in this chapter have the potential to interact with each other, which could give rise to synergistic impacts as a result of that interaction. The worst case impacts assessed within the chapter take these interactions into account and for the impact assessments are considered conservative and robust. For clarity the areas of interaction between impacts are presented in Table 22.30, along with an indication as to whether the interaction may give rise to synergistic impacts.

Table 22.30 Interaction between impacts

Potential interaction between impacts																			
Construction																			
	1 Statutory designated sites	2 Non-statutory designated sites	3 Arable land	4 Woodland, trees and scrub	5 Hedgerows	6 Grassland	7 Coastal habitats	8 Watercourses and ponds	9 Badgers	10 Bats	11 Water voles	12 Otter	13 Great crested newts	14 Reptiles	15 White-clawed crayfish	16 Other invertebrates	17 Fish	18 Protected flora	19 Invasive non-native species
1 Statutory designated sites	-	Yes	No	Yes	No	Yes	No	Yes	No	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes
2 Non-statutory designated sites	-	-	No	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Yes	No	No	No	No	No	No	Yes
3 Arable land	-	-	-	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No	No
4 Woodland, trees and scrub	-	-	-	-	Yes	No	No	No	No	Yes	No	No	No	Yes	No	No	No	No	Yes
5 Hedgerows	-	-	-	-	-	No	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	Yes
6 Grassland	-	-	-	-	-	-	No	No	No	Yes	No	No	Yes	Yes	No	No	No	Yes	Yes
7 Coastal habitats	-	-	-	-	-	-	-	No	No	No	No	No	No	No	No	No	No	No	No

Potential interaction between impacts																			
Construction																			
	1 Statutory designated sites	2 Non-statutory designated sites	3 Arable land	4 Woodland, trees and scrub	5 Hedgerows	6 Grassland	7 Coastal habitats	8 Watercourses and ponds	9 Badgers	10 Bats	11 Water voles	12 Otter	13 Great crested newts	14 Reptiles	15 White-clawed crayfish	16 Other invertebrates	17 Fish	18 Protected flora	19 Invasive non-native species
8 Watercourses and ponds	-	-	-	-	-	-	-	-	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
9 Badgers	-	-	-	-	-	-	-	-	-	No	No	No	No	No	No	No	No	No	No
10 Bats	-	-	-	-	-	-	-	-	-	-	No	No	No	No	No	No	No	No	No
11 Water voles	-	-	-	-	-	-	-	-	-	-	-	No	No	No	No	No	No	No	Yes
12 Otter	-	-	-	-	-	-	-	-	-	-	-	-	No	No	No	No	No	No	No
13 Great crested newts	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	No	No	No	Yes
14 Reptiles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	No	No	No
15 White-clawed crayfish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	No	Yes
16 Other invertebrate	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	No	Yes
17 Fish	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	No	Yes

Potential interaction between impacts																			
Construction																			
	1 Statutory designated sites	2 Non-statutory designated sites	3 Arable land	4 Woodland, trees and scrub	5 Hedgerows	6 Grassland	7 Coastal habitats	8 Watercourses and ponds	9 Badgers	10 Bats	11 Water voles	12 Otter	13 Great crested newts	14 Reptiles	15 White-clawed crayfish	16 Other invertebrates	17 Fish	18 Protected flora	19 Invasive non-native species
18 Protected flora	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	Yes
19 Invasive non-native species	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Operation																			
	1 Habitat and species during maintenance								2 Fauna during operational lighting and noise										
1 Habitat and species during maintenance	-								No										
2 Fauna during operational lighting and noise	-								-										
Decommissioning																			
It is anticipated that the decommissioning impacts will be no worse than those of construction.																			

22.11 Summary

771. A summary of the impact assessment for onshore ecology is presented in the tables below. Table 22.33 provides a summary of the impact assessment under Scenario 1, and Table 22.34 provides a summary of the impact assessment under Scenario 2. In accordance with the methodology for assessment presented in section 22.4 this table should only be used in conjunction with the additional narrative explanations provided in section 22.7.
772. Under Scenario 1, with the application of mitigation measures the project is predicted to have no greater than **minor adverse** impacts in relation to onshore ecology.
773. Under Scenario 2, the potential significance in surveyed areas with the application of mitigation is deemed to be no greater than **minor adverse** for most receptors. Potential **moderate adverse** impacts have been identified for bats and hedgerows, however, these impacts will reduce over time as replacement hedgerows mature (see sections 22.7.5.5 and 22.7.5.10).
774. In unsurveyed areas, the potential significance is also deemed to be not greater than **minor adverse** for most species following mitigation. Potential **moderate adverse** impacts have been identified for bats. For all unsurveyed areas where potential impacts have been identified, pre-construction ecological surveys will be undertaken and, where the presence of these species is confirmed, appropriate mitigation measures would be developed, adhering to Natural England Standing Advice, to reduce impacts.
775. Mitigation measures would be developed in consultation with the relevant Statutory Nature Conservation Body (SNCB) and Local Authority through the Ecological Management Plan in accordance with the OLEMS (document reference 8.7) submitted with the DCO application.

Table 22.31 Potential impacts identified for onshore ecology under Scenario 1

Potential Impact	Receptor	Importance	Significance (without mitigation) ²⁰		Mitigation	Residual Impact	
			Surveyed areas	Unsurveyed areas		Surveyed areas	Unsurveyed areas
Construction							
1	Statutory designated sites	High	Moderate adverse	N/A	Yes	Minor adverse	N/A
2	Non-statutory designated sites	Medium	Minor adverse	N/A	Yes	Minor adverse	N/A
3	Arable land	High	Minor adverse	N/A	Yes	Minor adverse	N/A
4	Woodland, trees and scrub	Negligible	No impact	N/A	N/A	No impact	N/A
5	Hedgerows	High	Moderate adverse	N/A	Yes	Minor adverse	N/A
6	Grassland	High	No impact	N/A	N/A	No impact	N/A
7	Coastal habitats	High	No impact	N/A	N/A	No impact	N/A
8	Watercourses and ponds	High	Moderate adverse	N/A	Yes	Minor adverse	N/A
9	Badgers	Low	Minor adverse	N/A	Yes	Negligible	N/A
10	Bats	High	Major adverse	N/A	Yes	Minor adverse	N/A
11	Water vole	Medium	Minor adverse	N/A	N/A	Minor adverse	N/A
12	Otter	High	Minor adverse	N/A	Yes	Minor adverse	N/A
13	Great crested newts	High	Minor adverse	Major adverse	Yes	Minor adverse	Minor adverse

²⁰ Significance is presented for both the impacts predicted based on survey data obtained to date and for the potential impacts which may arise if we assume that a receptor is present within the unsurveyed areas. Where the data obtained to date is adequate to fully described the ecological baseline, 'N/A' is presented within the 'unsurveyed' columns.

Potential Impact	Receptor	Importance	Significance (without mitigation) ²⁰		Mitigation	Residual Impact	
			Surveyed areas	Unsurveyed areas		Surveyed areas	Unsurveyed areas
14	Reptiles	Medium	Minor adverse	N/A	Yes	Minor adverse	N/A
15	White-clawed crayfish	High	No impact	N/A	N/A	No impact	N/A
16	Other invertebrates	High	No impact	N/A	N/A	No impact	N/A
17	Fish	High	Moderate adverse	N/A	Yes	Minor adverse	N/A
18	Protected flora	High	No impact	N/A	N/A	No impact	N/A
19	Invasive non-native species	Medium	Moderate adverse	Moderate adverse	Yes	Minor adverse	Minor adverse
Operation							
1	Habitat and species during maintenance	High	Minor adverse	N/A	N/A	Minor adverse	N/A
2	Fauna during operational lighting and noise	High	Minor adverse	N/A	Yes	Minor adverse	N/A
Decommissioning							
Impacts no worse than those during construction							
Cumulative – construction and operation							
Impacts as per construction and operation for all potential impacts.							
Cumulative – decommissioning							
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.							

Table 22.32 Potential impacts identified for onshore ecology under Scenario 2

Potential Impact	Receptor	Importance	Significance ²¹		Mitigation	Residual Impact	
			Surveyed areas	Unsurveyed areas		Surveyed areas	Unsurveyed areas
Construction							
1	Statutory designated sites	High	Moderate adverse	N/A	Yes	Minor adverse	N/A
2	Non-statutory designated sites	Medium	Minor adverse	N/A	Yes	Minor adverse	N/A
3	Arable land	High	Minor adverse	N/A	Yes	Minor adverse	N/A
4	Woodland, trees and scrub	Negligible	Negligible	N/A	Yes	Negligible	N/A
5	Hedgerows	High	Moderate adverse	N/A	Yes	Moderate adverse	N/A
6	Grassland	High	Minor adverse	N/A	Yes	Minor adverse	N/A
7	Coastal habitats	High	No impact	N/A	N/A	No impact	N/A
8	Watercourses and ponds	High	Moderate adverse	N/A	Yes	Minor adverse	N/A
9	Badgers	Low	Minor adverse	Minor adverse	Yes	Minor adverse	Minor adverse
10	Bats	High	Major adverse	Major adverse	Yes	Moderate adverse	Moderate adverse
11	Water vole	Medium	Moderate adverse	Moderate adverse	Yes	Minor adverse	Minor adverse
12	Otter	High	Minor adverse	N/A	Yes	Minor adverse	N/A

²¹ Significance is presented for both the impacts predicted based on survey data obtained to date and for the potential impacts which may arise if we assume that a receptor is present within the unsurveyed areas. Where the data obtained to date is adequate to fully describe the ecological baseline, 'N/A' is presented within the 'unsurveyed' columns.

Potential Impact	Receptor	Importance	Significance ²¹		Mitigation	Residual Impact	
			Surveyed areas	Unsurveyed areas		Surveyed areas	Unsurveyed areas
13	Great crested newts	High	Minor adverse	Major adverse	Yes	Minor adverse	Minor adverse
14	Reptiles	Medium	Minor adverse	Moderate adverse	Yes	Minor adverse	Minor adverse
15	White-clawed crayfish	High	No impact	N/A	N/A	No impact	N/A
16	Other invertebrates	High	No impact	N/A	Yes	No impact	N/A
17	Fish	High	Moderate adverse	N/A	Yes	Minor adverse	N/A
18	Protected flora	High	No impact	N/A	N/A	No impact	N/A
19	Invasive non-native species	Medium	Moderate adverse	Moderate adverse	Yes	Minor adverse	Minor adverse
Operation							
1	Habitat and species during maintenance	High	Minor adverse	N/A	N/A	Minor adverse	N/A
2	Fauna during operational lighting and noise	High	Minor adverse	N/A	Yes	Minor adverse	N/A
Decommissioning							
Impacts similar to those during construction							
Cumulative – construction and operation							
Impacts as per construction and operation for all potential impacts.							
Cumulative – decommissioning							
The detail and scope of the decommissioning works will be determined by the relevant legislation and guidance at the time of decommissioning and agreed with the regulator. A decommissioning plan will be provided. As such, cumulative impacts during the decommissioning stage are assumed to be no worse than those identified during the construction stage.							

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