

Norfolk Boreas Offshore Wind Farm

Chapter 23

Onshore Ornithology

Environmental Statement

Volume 1

Applicant: Norfolk Boreas Limited
Document Reference: 6.1.23
RHDHV Reference: PB5640-006-023
Pursuant to APFP Regulations: 5(2)a)

Date: June 2019
Revision: Version 1
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Photo: Ormonde Offshore Wind Farm

Date	Issue No.	Remarks / Reason for Issue	Author	Checked	Approved
01/03/2019	01D	First draft for Norfolk Boreas Limited review	GC	CS/JL	CD/JL
07/03/2019	02D	Second draft for Norfolk Boreas Limited review	GC	CD/JL	AmH/JL
29/04/2019	01F	Final for DCO submission	GC	CD/AD	JL



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Glossary of Acronyms

AONB	Area of Outstanding Natural Beauty
BCT	Bat Conservation Trust
BoCC4	Birds of Conservation Concern 4
BTO	British Trust for Ornithology
CIA	Cumulative Impact Assessment
CIEEM	Chartered Institute for Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
CoCP	Code of Construction Practice
CRoW	Countryside and Rights of Way Act
CWS	County Wildlife Site
DCO	Development Consent Order
DECC	Department for Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
EclA	Ecological Impact Assessment
ECoW	Ecological Clerk of Works
EEC	European Economic Community
EIA	Environmental Impact Assessment
EPP	Evidence Plan Process
ES	Environmental Statement
ETG	Expert Topic Group
EU	European Union
GB	Great Britain
HDD	Horizontal Directional Drilling
HRA	Habitats Regulations Assessment
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
NBIS	Norfolk Biodiversity Information Service
NERC	Natural Environment and Rural Communities Act
NGR	National Grid Reference
NNR	National Nature Reserve
NPPF	National Planning Policy Framework
NPS	National Policy Statement
OLEMS	Outline Landscape Environmental Management Strategy
PEIR	Preliminary Environmental Information Report
PRoW	Public Right of Way
pSPA	Potential Special Protection Area
RNR	Roadside Nature Reserve
S41	Section 41 (NERC Act)
SAC	Special Area of Conservation

SoS	Secretary of State
SINC	Site of Importance for Nature Conservation
SPA	Special Protection Area
SSSI	Site of Special Scientific Interest
TN	Target Note
UKHPI	UK Habitats of Principal Importance
UKSPI	UK Species of Principal Importance
WeBS	Wetland Bird Survey

Glossary of Terminology

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.
Evidence Plan Process	A voluntary consultation process with specialist stakeholders to agree the approach to the EIA and information to support the HRA.
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.
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 power and communications 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 infrastructure	The combined name for all onshore infrastructure associated with the project from landfall to grid connection.
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	The track along the onshore cable route which the construction traffic would use to access workfronts.
Transition pit	Underground structures that house the joints between the offshore export cables and the onshore cables.
Trenchless crossing compound	Pairs of compounds at each trenchless crossing zone to allow boring to take place from either side of the crossing.
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.

23 ONSHORE ORNITHOLOGY

23.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the potential impacts of the proposed Norfolk Boreas project (herein ‘the project’) on onshore ornithology. This chapter is concerned with birds and their terrestrial habitats; potential impacts upon offshore birds are considered in Chapter 13 Offshore Ornithology.
2. This chapter provides an overview of the existing baseline environment with respect to onshore ornithology within a study area around the project onshore area. This chapter then provides an Ecological Impact Assessment (EclA) of the potential impacts of construction, operation and decommissioning of the onshore infrastructure for the project based on this baseline environment.
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 will therefore be undertaken using the following two alternative scenarios (further details are presented in Chapter 5 Project Description) and 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.
5. This EclA also considers transboundary impacts, and cumulative impacts of existing and proposed projects in respect of onshore ornithology.
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 ornithology. The relevant chapters are:
 - Chapter 13 Offshore Ornithology;
 - Chapter 20 Water Resources and Flood Risk;
 - Chapter 22 Onshore Ecology;
 - Chapter 25 Noise and Vibration;
 - Chapter 26 Air Quality; and
 - Chapter 29 Landscape and Visual Impact Assessment.

23.2 Legislation, Guidance and Policy

23.2.1 Legislation

7. There are a number of pieces of legislation applicable to onshore ornithology. A summary of the key pieces of International and UK legislation relevant to this chapter are provided in the following sections.
8. In 2017, the UK government triggered article 50 of the Treaty on European Union (TEU) and is currently in negotiations (at the time of writing) to withdraw as a Member State from the European Union (EU) (herein termed 'Brexit'). The European Union (Withdrawal) Act 2018 ensures that all statutory instruments created under EU Directives, including The Conservation of Habitats and Species Regulations 2017 (see below), will continue to apply once the UK exits the European Union.

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

9. The 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) and these are implemented in the UK through The Conservation of Habitats and Species Regulations 2017.

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

10. This Directive provides a framework for the conservation and management of wild birds in Europe. 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.

23.2.1.3 Wildlife and Countryside Act 1981 (as amended)

11. The 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.
12. The Act makes provision for the notification and confirmation of Sites of Special Scientific Interest (SSSI).

23.2.1.4 The Conservation of Habitats and Species Regulations 2017

13. 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.
14. 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.

23.2.1.5 Natural Environment and Rural Communities (NERC) Act 2006

15. Section 41 of the Act requires the Secretary of State (SoS) to compile a list of habitats and species of principal importance for the conservation of biodiversity in England (herein 'S41 species').
16. 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.

23.2.1.6 Marine and Coastal Access Act 2009

17. 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.

23.2.1.7 Countryside and Rights of Way Act 2000 (CRoW)

18. The Act amends the law relating to Public Rights of Way (PRoW) 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.

23.2.2 Guidance

19. The EclA 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; and
 - Construction Industry Research and Information Association CIRIA Guidance note C692 Environmental Good Practice on Site Guide (3rd edition).

20. The following species-specific guidance and standards have been used during the assessment process:

- Natural England (2015) Standing advice on wild birds.

23.2.3 Policy

23.2.3.1 National Planning Policy Framework (NPPF)

21. 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”.*

23.2.3.2 Natural Environment White Paper 2011

22. 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.

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

23. 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).

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

24. 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 200,000 hectares (ha);
- 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, we will see an overall improvement in the status of our wildlife and will have prevented further human-induced extinctions of known threatened species; and
- By 2020, significantly more people will be engaged in biodiversity issues, aware of its value and taking positive action.

23.2.3.5 National Policy Statements

25. The assessment of potential impacts upon onshore ornithology 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).

26. The specific assessment requirements for onshore ornithology, as detailed in the NPSs, are summarised in Table 23.1, together with an indication of the paragraph numbers of the ES chapter where each is addressed. Where any part of the NPS has not been followed within the assessment, an explanation as to why the requirement was not considered relevant, or has been met in another manner, is provided.

Table 23.1 NPS assessment requirements

NPS requirement	NPS reference	ES reference
EN-1 Overarching NPS for Energy		
'Where the development is subject to [Environmental Impact Assessment] EIA the applicant should ensure that the Environmental Statement (ES) clearly sets out any effects on internationally, nationally and locally designated sites of	Section 5.3.3.	Existing environment is discussed in section 23.6. Assessment is set out in sections 23.7 and 23.8.

NPS requirement	NPS reference	ES reference
<p>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) consider thoroughly the potential effects of a proposed project.'</p>		
<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.	<p>Embedded mitigation measures are presented in section 23.7.1 and further mitigation measures are set out in sections 23.7 and 23.8.</p>
<p>'When considering the application, the IPC will have regard to the Government's biodiversity strategy is 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, 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.'</p>	Sections 5.3.5 – 5.3.8.	<p>Embedded mitigation measures are presented in section 23.7.1 and further mitigation measures are set out in sections 23.7 and 23.8.</p>
<p>'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.'</p>	Section 5.3.9.	<p>Designated sites are discussed in section 23.6. Assessment is set out in sections 23.7 and 23.8. Site selection decisions have been made to avoid interest features at designated sites.</p>
<p>'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.'</p>	Section 5.3.11	<p>Designated sites are discussed in section 23.6. Assessment is set out in sections 23.7 and 23.8 Site selection decisions have been made to avoid interest features at designated sites.</p>

NPS requirement	NPS reference	ES reference
<p>‘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.</p> <p>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.’</p>	Section 5.3.11	Designated sites are discussed in section 23.6.. Assessment is set out in sections 23.7 and 23.8. Site selection decisions have been made to avoid interest features at designated sites.
<p>‘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.’</p>	Section 5.3.13	Designated sites are discussed in section 23.6. Assessment is set out in sections 23.7 and 23.8. Site selection decisions have been made to avoid interest features at designated sites.
<p>The IPC will aim to maximise opportunities to build in beneficial biodiversity features when considering proposals as part of good design.</p>	Section 5.3.15	Embedded mitigation measures are presented in section 23.7.1 and further mitigation measures are set out in sections 23.7 and 23.8. 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 23.6. Assessment is set out in sections 23.7 and 23.8.
<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, 	Section 5.3.18	Embedded mitigation measures are presented in section 23.6 and further mitigation measures are set out in sections 23.7 and 23.8. This includes replanting and reinstatement of habitat where considered necessary.

NPS requirement	NPS reference	ES reference
including as a consequence of transport access arrangements; <ul style="list-style-type: none"> 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. 		
'The IPC will need to take account of what mitigation measures may have been agreed between the applicant and 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 23.7.1 and further mitigation measures are set out in sections 23.7 and 23.8.
EN-3 NPS for Renewable Energy Infrastructure		
'Proposals for renewable energy infrastructure should demonstrate good design in respect of landscape and visual amenity, and in the design of the project to mitigate impacts such as noise and effects on ecology.'	Section 2.4.2	Project design has avoided sensitive features where possible. Embedded mitigation measures are presented in section 23.7.1 and further mitigation measures are set out in sections 23.7 and 23.8.
'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 23.7 and 23.8.
'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 23.7.7

23.2.3.6 Local Planning Policy

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

“Other matters that the IPC [now the Planning Inspectorate] 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.”

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

- Norfolk County Council;
- Breckland District Council;

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

29. Table 23.2 provides details of the local planning policy documents and the relevant policies in respect of onshore ornithology. Designated areas which these policies may refer to are shown in Chapter 22 Onshore Ecology Figure 22.2.

Table 23.2 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 District 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/ LNRs; • 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 (County Wildlife Sites (CWS), Ancient woodland, LNRs, 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

Document	Policy / guidance	Policy / guidance purpose
		<p>feature(s), including protected trees and hedgerows will not normally be permitted.</p> <p>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.</p> <p>Appropriate landscaping schemes to mitigate against the landscape impact of and complement the design of new development will be required, where appropriate.</p>
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.
	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.

23.3 Consultation

30. 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 ornithology 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 consultation process to date has been incorporated into this ES.
31. Further consultation has been undertaken through Expert Topic Group (ETG) meetings, with the most recent meeting being held in February 2019. Full details of the project consultation process are presented within Chapter 7 Technical Consultation and the Consultation Report (Document reference 5.1), which has been submitted with the DCO application.
32. 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 23.5.
33. A summary of the consultation undertaken for Norfolk Boreas to date that has been used in the development of this assessment is provided in Table 23.3.

Table 23.3 Norfolk Boreas Consultation responses

Consultee	Document / Date	Comment	Response / where addressed in the ES
Natural England	Email response to <i>Norfolk Boreas Offshore Wind Farm Wintering Birds Survey—agreement of approach</i> September 2017	Given that Norfolk Boreas is following the same cable route we are content for the [Norfolk] Vanguard data to be used. We advise that if there is a significant gap between the construction of the two projects (2 years plus) that a further pre-construction survey should be undertaken to verify that nothing has changed.	Baseline data collected for the Norfolk Vanguard data is presented in section 23.6 of this chapter.
Natural England	Email response to <i>Norfolk Boreas Offshore Wind Farm Wintering Birds Survey—agreement of approach</i> September 2017	We also wish to highlight that in our previous advice to the Norfolk Vanguard project ... we recommended that together with any survey, information about predicted crop patterns at the time of the proposed work should be considered...It would also be advisable to consider things such as the size of fields the SPA species may use or too disturbed due to proximity to roads.	These factors are considered in sections 23.7 and 23.8 of this chapter.
Secretary of State	Scoping Opinion June 2017	Impacts on legally protected and notable species during operation and temporary/permanent habitat loss during decommissioning appear to have been scoped out. It is not clear from the wording of the Scoping Report why these impacts would not occur – for instance, if access to buried cables was required as suggested in paragraph 1169 whether there is potential for direct effects on birds. Equally if the effects of decommissioning are predicted to be similar to those of construction, habitat loss should be equally relevant to the decommissioning phase. The SoS does not feel that there is sufficient evidence to agree to the scoping out of these effects.	Impacts on legally protected and notable bird species during operation and temporary/permanent habitat loss during decommissioning have been scoped into the assessment and are considered in sections 23.7 and 23.8 of this chapter.
Natural England	Scoping Opinion June 2017	Passage and over wintering birds are listed as red on [Birds of Conservation Concern] BoCC 4 (Eaton et al. 2015), along with their relative abundance (high, medium, low), which has been based on the data from the BTO UK Bird Atlas 2007-2011. We advise the inclusion of the same information for breeding birds for the scoping area. When listing the UK bird species of principal importance (excluding BoCC red	Impacts on notable breeding birds located within the study area are considered in sections 23.7 and 23.8 of this chapter.

Consultee	Document / Date	Comment	Response / where addressed in the ES
		list species), which may be present within the onshore scoping area, we recommend the Applicant clarifies whether this list considers species that may be present during just the passage and wintering period, or whether it also includes species that may be present during the breeding season as well.	
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	Response to Norfolk Boreas Onshore Ecology and Ornithology Method Statement January 2018	Natural England agree that scope of the Extended Phase 1 Habitat Survey and maximum case scope of the Phase 2 species-specific surveys as outlined in section 3.2 of the Norfolk Boreas Onshore Ecology and Onshore Ornithology Method Statement is considered sufficient for augmenting the existing data to sufficiently characterise the existing environment.	No further bird surveys were proposed under section 3.2 of the Norfolk Boreas Onshore Ecology and Onshore Ornithology Method Statement.
Natural England	PEIR October 2018	Due to Natural England's ongoing engagement with Norfolk Vanguard OWF examination and similarities between the sister projects, including the content of their Environmental Statements, we believe that it would be most beneficial to the project to take into account the evolving position on many key issues.	Norfolk Boreas has considered in the production of this ES the key issues raised with respect to onshore ornithology from the Norfolk Vanguard Relevant Representations (please see Appendix 23.5 for details).

23.4 Assessment Methodology

23.4.1 Ecological Impact Assessment (EclA) Methodology

34. The EclA methodology proposed in relation to onshore ornithology is based on the Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine by CIEEM (2018). These 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.
35. The approach to determining the significance of an impact follows a systematic process for all impacts. This involves identifying the 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.
36. This 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 (2018) guidelines. As a result, the assessed significance level may not always be directly attributed to the guidance matrix detailed in the following sections.

23.4.1.1 Importance

37. The first stage of an EclA is determining the ‘importance’ of ornithological features or ‘receptors’. CIEEM (2018) 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 bird species.
38. When evaluating the nature conservation importance of an ornithological receptor within the onshore infrastructure, it is the importance of the site for the species under consideration that is assessed, rather than the importance of the species at a national or international level. For example, while a species such as skylark *Alauda arvensis* would be considered to be a species of national conservation importance by virtue of being a red-listed species of conservation concern (Eaton et al., 2015) and a priority species under the Biodiversity 2020 strategy for England, the importance of a site which was only used occasionally by a small number of birds would be negligible.

39. For this EclA, the guidelines outlined in Table 23.4 will be followed to provide the relative importance of different ecological features.

Table 23.4 Definitions of importance levels for onshore ornithology

Importance	Definition
High	<ul style="list-style-type: none"> • An internationally designated site (e.g. SPA) as designated under the Birds Directive or Ramsar Convention, candidate sites, qualifying features connected to a nearby SPA (e.g. shorebird assemblage), or an area meeting the criteria for an international designation. • A nationally designated site or area meeting criteria for national level designations (e.g. SSSI). • A regularly occurring, nationally important population of any internationally important species listed under Annex I of the Birds Directive, or regularly occurring migratory species connected to a SPA designated for this species under the Birds Directive. • A regularly occurring, regionally important population of any nationally important species listed as a Biodiversity 2020 priority species and species listed under Schedule 1 of the Wildlife and Countryside Act or Annex I of the Birds Directive.
Medium	<ul style="list-style-type: none"> • Habitats or species that form part of the cited interest of a Local Nature Reserve, or some local-level designated sites depending on specific site conditions. • A feature (e.g. habitat or population) which is either unique or sufficiently unusual to be considered as being of nature conservation value up to a district or county context. • A regularly occurring, locally important population of any nationally important species listed as a Biodiversity 2020 priority species and species listed under Schedule 1 of the Wildlife and Countryside Act or Annex I of the Birds Directive. • Other species of conservation concern, including species listed under the UK BoCC.
Low	<ul style="list-style-type: none"> • Habitats or species that form part of the cited interest of a local-level designated site and may be designated as a non-statutory Site of Importance for Nature Conservation (SINC) or the equivalent (e.g. Local Wildlife Site, Ancient Woodland designation). • A feature (e.g. habitat or population) that is of nature conservation value in a local context only, with insufficient value to merit a formal nature conservation designation. All other species that are widespread and common and which are not present in locally, regionally or nationally important numbers which are considered to be of low or poor ecological value (e.g. UK Birds of Conservation Concern Green List species).
Negligible	<ul style="list-style-type: none"> • Common place species of little or no conservation significance. Loss of such a species from the site would not be seen as detrimental to the ecology of the area.

40. In addition to the features listed in Table 23.4, ecological features which play a key functional role in the landscape or are locally rare have also been considered. The importance of such features has been determined using professional judgement.
41. CIEEM places the emphasis on using professional judgement when considering 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.

23.4.1.2 Magnitude

42. The magnitude of effect 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 summarises the definitions of magnitude levels for onshore ornithology.

Table 23.5 Definitions of magnitude levels for onshore ornithology

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 impact	A potential impact that is not expected to affect the feature / population in any way, therefore no effects are predicted.

23.4.1.2.1 Duration

43. 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.

44. Where deviations from these definitions are used within section 23.7, this is explained within the text.

23.4.1.3 Impact significance

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

46. 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).

47. 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.

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

23.4.1.3.1 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?

23.4.1.3.2 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.
- **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).

49. Following the identification of receptor importance and magnitude of effect, the significance of the impact has been considered using the matrix presented in Table 23.6 and knowledge of the ecological features affected.

50. 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 23.6 Impact significance matrix

		Negative magnitude				Beneficial magnitude			
		High	Medium	Low	Negligible	Negligible	Low	Medium	High
Sensitivity	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

51. The impact significance categories are defined as shown in Table 23.7.

Table 23.7 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.
No change	No impact, therefore no change in receptor condition.

52. Note that for the purposes of this ES, 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.

53. Embedded mitigation has been referred to and included in the initial assessment of impact. If the impact does not require additional mitigation (or none is possible) the residual impact remains the same. If, however, additional mitigation is required or will help reduce effects as far as possible, an assessment of the post-mitigation residual impact is provided.

23.4.2 Cumulative Impact Assessment

54. Chapter 6 EIA Methodology provides a summary of the Cumulative Impact Assessment (CIA) methodology. This chapter focuses on those cumulative impacts that are specific to onshore ornithology.
55. The key consideration used in relation to linear development such as the onshore infrastructure is whether there is spatial or temporal overlap of effects from projects on the same receptors. For instance, 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 a 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.
56. 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 are exceptional circumstances it is accepted that such projects may contribute to a wider cumulative impact.
57. 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.
58. Further details of the methods used for the CIA for onshore ornithology are provided in section 23.8.

23.4.3 Transboundary Impact Assessment

59. There are no transboundary impacts with regards to onshore ornithology as the onshore infrastructure is not sited in proximity to any international boundaries and therefore is not considered further in this assessment.

23.4.4 Habitats Regulations Assessment

60. An Information to Inform Habitats Regulations Assessment (HRA) Report (herein 'HRA Report') (Document reference 5.3) has been prepared for the project and will be submitted alongside the project EIA as part of the DCO submission. The HRA Report contains an assessment of whether or not the project is likely to give rise to a likely significant effect upon the integrity of a European site (i.e. SPA, SAC or Ramsar sites), either alone or in combination with other projects.
61. This chapter draws on the information provided and assessment presented in the HRA Report that is relevant to potential impacts upon ornithological receptors which are associated with European sites and their qualifying features.
62. For more details regarding the HRA assessment, please refer to the HRA Report (Document reference 5.3) submitted as part of the DCO application.

23.5 Scope

23.5.1 Study Area

63. The onshore development footprint is referred to hereafter as the onshore project area and is shown in Figure 23.1. The onshore infrastructure considered at this stage 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.
64. The onshore infrastructure is set out in full detail in Chapter 5 Project Description.
65. The study areas for onshore ornithological receptors used in this EclA are provided in Table 23.8. 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 using professional judgement. All study areas are shown on Figure 23.1.

Table 23.8 Study areas for different onshore ornithology receptors used for this EclA

Receptor	Study area
Internationally designated sites	Within 5km of the onshore project area (Figure 23.1)
Designated sites (Nationally designated and non-statutory sites)	Within 2km of the onshore project area (Figures 23.1a to 23.1c)
Species	Within 50m of the onshore project area (Figures 23.1a to 23.1c)

23.5.2 Data Sources

66. This EclA has been informed by desk-based information and field survey data collected with respect to Norfolk Vanguard. As this data covers the same footprint as Norfolk Boreas, it is therefore suitable for characterising the baseline which has been used to inform this EclA. This approach has been agreed in consultation with Natural England and Norfolk County Council (see section 23.3).
67. Data was collected for Norfolk Vanguard from July 2016 onwards, with field surveys completed in 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 23.3). 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. Additional baseline data has also been collected specifically for Norfolk Boreas during February 2018, through an Extended Phase 1 Habitat Survey of previously unsurveyed areas within the onshore project area.
68. All of the data sources used to inform the EclA are summarised in Table 23.9.

Table 23.9 Data sources

Data source	Date	Data	Coverage / data gaps	Status
Desk study data				
Joint Nature Conservation Committee (JNCC)	July 2016	Internationally designated sites (SPA, SAC, Ramsar sites)	Onshore project area plus a 5km buffer	Data obtained
JNCC Natural England	July 2016	UK designated sites (SSSI, NNR, LNR)	Onshore project area plus a 2km buffer	Data obtained
JNCC	July 2016	UK Habitats of Principal Importance	Onshore project area plus a 50 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 Schedule 1; • Bonn Convention Appendix 1 & 2; • Bern Convention Appendix 2 & 3; • NERC Act 2006 Section 41 species; • UK species of principal importance (both local and national); • BoCC4 Red and Amber list species; • Locally Rare species. 	Onshore project area plus a 2km buffer	Data obtained
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
Natural England	August 2016	Sensitivity maps for the following Broadland SPA species from 1986/87 to 2012/13: <ul style="list-style-type: none"> • Berwick's Swan; • Whooper swan; and • Pink-footed goose 	10km buffer around Broadland SPA	Data obtained

Data source	Date	Data	Coverage / data gaps	Status
Natural England	March 2017	Location of sand martin nests at Happisburgh coastline	Happisburgh	Data obtained
Norfolk Local Biodiversity Action Plan (LBAP)	June 2017	Lists of Norfolk priority habitat and species.	Onshore project area plus a 50m buffer	Data obtained
Field survey data				
2017 Extended Phase 1 Habitat Survey	February 2017	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"> assessment of suitable habitats to support common and notable¹ breeding birds. 	Onshore project area plus a 50m buffer Coverage of approx. 50% of survey area achieved.	Full survey results available
Wintering bird surveys	February 2017	A survey of ex situ habitats of the Broadland SPA, and of those SSSI within 1km of the cable route which support wintering bird interest features. This includes surveys of the following areas: <ul style="list-style-type: none"> Agricultural fields in North Walsham District; Dereham Rush Meadows SSSI; Hundred Stream; and North Norfolk Coast between Eccles-on-Sea and Paston. 	Habitats within 300m ² of the onshore infrastructure and 5km of the Broadland SPA; SSSI within 300m of the onshore infrastructure.	Full survey results available
Breeding bird survey	August 2017	A breeding bird surveys of the following areas: <ul style="list-style-type: none"> Booton Common SSSI; Dillington Carr SSSI; Dereham Rush Meadows SSSI; Land South of Dillington Carr CWS; 	Designated sites supporting ornithological interest features within 300m of the onshore infrastructure.	Full survey results available

¹ Notable species are defined here as those listed on Annex 1 of the Birds Directive, UK Red or Amber List species, UKSPI or Norfolk LBAP species.

² A 300m buffer for potential impacts on wintering and breeding bird species was agreed with Natural England in January 2017 (Onshore Wintering Bird Surveys Survey Methodology Approach Update (Document reference: PB4476.003.038), based on an estimated the maximum distance that bird species are likely to be subject to disturbance effects from construction activities provided by Ader & Bryant (2003).

Data source	Date	Data	Coverage / data gaps	Status
		<ul style="list-style-type: none"> Coastal floodplain grazing marsh habitat has been identified along the habitats adjacent to the river within the survey area; and Pigney's Wood LNR. 		
2018 Extended Phase 1 Habitat Survey	February 2018	<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, 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"> assessment of suitable habitats to support common and notable breeding birds. 	<p>15 'priority areas' located within the onshore infrastructure (plus a 50m buffer) for which data was not obtained in 2017</p> <p>2017 and 2018 surveys achieved a combined coverage of approx. 65% of survey area.</p>	Full survey results available

23.5.3 Assumptions and Limitations

69. 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 do not necessarily contain full details of or spatial 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.
70. 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 Norfolk 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.
71. 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 these areas where access was not possible, in combination with other desk study data (e.g. the bird sensitivity maps).
72. For the purposes of this EclA and where survey data is not forthcoming, under a precautionary approach it has been assumed that protected or notable species may be present within these unsurveyed areas. In these instances, an assessment of the habitat available has been made using Extended Phase 1 Habitat Survey or Norfolk Living Map data, and assessment of those species which are likely to utilise these habitats has been made. The data gaps encountered due to the lack of full landowner access will be subject to full surveys post-consent, when complete landowner access is available.

73. Some habitats could not be fully accessed during the 2017 and 2018 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 as potentially providing field signs which could not be picked up during the field surveys.
74. The Extended Phase 1 Habitat Surveys which have been used to provide baseline information regarding the suitability of habitats for supporting bird species were conducted 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 habitats which have the potential to support breeding or wintering or on passage birds.
75. Following feedback from Natural England as part of the EPP (see Section 23.3), the potential for local cropping patterns to influence the findings of the surveys was considered. Although some fields were recently ploughed during the survey, the majority of crops in place over winter within the wintering bird survey area (winter crop, fallow (grass)) would provide suitable foraging habitat for pink-foot geese, and as such the survey results recorded over winter in 2016/2017 provided a robust estimate of the use of these habitats by qualifying features of the Broadland SPA and Ramsar site.
76. The 2017 breeding bird survey commenced in May and as such no survey visit was undertaken in April, as set out in the Onshore Ecology and Onshore Ornithology Method Statement (Royal HaskoningDHV, 2018, unpublished). All of the remaining survey visits (May – early August 2017) were undertaken within all survey areas, therefore the absence of an April survey visit is not anticipated to pose a significant constraint upon the survey results, although it may mean that some early singers such as mistle thrush *Turdus viscivorus*, dunnock *Prunella modularis*, bullfinch *Pyrrhula pyrrhula*, lesser spotted woodpecker *Dryobates minor* and great spotted woodpecker *Dryobates major* are underrepresented.
77. Whilst the survey teams comprised suitably qualified and professional ecological surveyors (qualification and experience are contained within all ecological survey reports provided as appendices to this chapter) and surveyors made the utmost effort to cover every habitat and pick up and identify all birds present during the field surveys carefully following the relevant established methodology, on occasion due to human error some sightings may have been missed or mis-recorded. Despite this, the data presented in the survey reports is considered to provide an accurate description and characterisation of the habitats and a suitably accurate account of species presence / absence within the survey area to enable a robust EclA to be undertaken.

23.6 Existing Environment

23.6.1 International Statutory Designated Sites

78. A total of four international statutory designated sites for nature conservation with an ornithological interest or qualifying feature are located within the internationally designated site study area (as defined in section 23.5.1). These are:
- Broadland SPA and Ramsar site and The Broads SAC;
 - Paston Great Barn SAC;
 - River Wensum SAC; and
 - Norfolk Valley Fens SAC.
79. One of these sites, the River Wensum SAC, is also located directly within the onshore project area. The location of these sites is shown on Figure 2 in Appendix 23.1.
80. The River Wensum SAC, The Broads SAC, Paston Great Barn SAC and Norfolk Valley Fens SAC are not designated for ornithological interest features, and as such are not considered further within this assessment. Therefore, only the Broadland SPA and Ramsar site will be considered in the subsequent section.

23.6.1.1 Broadland SPA

81. The Broadland SPA site is located outside of the onshore project area approximately 4.5km to the south. Table 23.10 provides a summary of the qualifying features (habitats and species) for this site.

Table 23.10 Qualifying features of the Broadland SPA (population counts are derived from the SPA citation)

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

Over winter:

Bewick's swan *Cygnus columbianus bewickii*, 495 individuals representing up to 7.1% of the wintering population in Great Britain (5 year peak mean 1987/8-1991/2)

Bittern *Botaurus stellaris*, 2-3 individuals representing up to 10-15% of the wintering population in Great Britain (5 year peak mean 1987/8-1991/2)

Hen harrier *Circus cyaneus*, 22 individuals representing up to 3% of the wintering population in Great Britain (5 year peak mean 1987/8-1991/2)

Ruff *Philomachus pugnax*, 96 individuals representing up to 6.4% of the wintering population in Great Britain (5 year peak mean 1987/8-1991/2)

Whooper swan *Cygnus cygnus*, 121 individuals representing up to 2% of the wintering population in Great Britain (5 year peak mean 1987/8-1991/2)

Marsh harrier *Circus aeruginosus*, 16 individuals representing up to 16% of the wintering population in Great Britain (5 year peak mean 1987/8-1991/2)

This site also qualifies under Article 4.2 of the Directive (79/409/EEC) by supporting populations of European importance of the following migratory species:

Over winter:

Gadwall *Anas strepera*, 486 individuals representing up to 4.0% of the wintering North-western Europe population (5 year peak mean 1987/8-1991/2)

This site qualifies under Article 4.1 of the Directive (79/409/EEC) by supporting populations of European importance of the following species listed on Annex I of the Directive:

Shoveler *Anas clypeata*, 675 individuals representing up to 1.7% of the wintering North-western Europe population (5 year peak mean 1987/8-1991/2)

Widgeon *Anas penelope*, 8,966 individuals representing up to 1.2% of the wintering North-western Europe population (5 year peak mean 1987/8-1991/2)

The following species was also included under the SPA Review (Stroud et al. 2001):

Pink-footed goose *Anser brachyrhynchus*, 3,290 individuals representing up to 1.5% of the wintering Eastern Greenland/Iceland/UK population (5 year peak mean 1994/5-1998/9)

Under the SPA Review (Stroud et al., 2001), the area also qualifies under Article 4.2 of the Directive (79/409/EEC) by regularly supporting at least 20,000 waterfowl

Over winter, the area regularly supports 22,603 individual waterfowl (RSPB, Count 99/00) including:

Cormorant *Phalacrocorax carbo*, Bewick's swan *Cygnus columbianus bewickii*, Whooper Swan *Cygnus cygnus*, Ruff *Philomachus pugnax*, Pink-footed goose *Anser brachyrhynchus*, Gadwall *Anas strepera*, Bittern *Botaurus stellaris*, Great crested grebe *Podiceps cristatus*, Coot *Fulica atra*, Bean goose *Anser fabalis*, White-fronted goose *Anser albifrons*, Widgeon *Anas penelope*, Teal *Anas crecca*, Pochard *Aythya ferina*, Tufted duck *Aythya fuligula*, Shoveler *Anas clypeata*.

82. Natural England has supplied draft maps of functionally-linked (i.e. supporting) land for pink-footed goose outside of the Broadland SPA boundary (Natural England, 2016). This information provides additional baseline data on the key areas for this species within the onshore project area. A copy of these draft maps are provided in Appendix 23.3a.
83. The maps indicate that, based on the 2008/9-2012/3 distribution, the key feeding areas for pink-footed geese within the internationally designated sites study area are located in a triangle between the villages of Happisburgh, Bacton and Witton Bridge, all of which are towards the east of the internationally designated sites study area (Figure 25.1).
84. Natural England has also provided draft maps showing the distribution of Bewick's Swan and Whooper Swan within Norfolk (Natural England, 2016). These indicate that the key areas for these species are within the Broadland SPA boundary. A copy of these draft maps are provided in Appendix 23.3b.

23.6.1.2 Broadland Ramsar site

85. Broadland Ramsar site is located approximately 4.5km south of the onshore project area at its closest point. Table 23.11 provides a summary of the qualifying features for which this site is afforded protection.

Table 23.11 Qualifying features of the Broadland Ramsar site (population counts are derived from the Ramsar Information Sheet)

Ramsar criterion 6 – species/populations occurring at levels of international importance. Qualifying Species/populations (as identified at designation):
<p>Species with peak counts in winter:</p> <p>Tundra swan, NW Europe 196 individuals, representing an average of 2.4% of the GB population (5 year peak mean 1998/9- 2002/3).</p> <p>Eurasian wigeon, NW Europe 6769 individuals, representing an average of 1.6% of the GB population (5 year peak mean 1998/9-2002/3).</p> <p>Gadwall, NW Europe 545 individuals, representing an average of 3.1% of the GB population (5 year peak mean 1998/9- 2002/3).</p> <p>Northern shoveler, NW & C Europe 247 individuals, representing an average of 1.6% of the GB population (5 year peak mean 1998/9- 2002/3).</p>
Species/populations identified subsequently to designation for possible future consideration under criterion 6.
<p>Species with peak counts in winter:</p> <p>Pink-footed goose, Greenland, Iceland/UK 4263 individuals, representing an average of 1.7% of the population (5 year peak mean 1998/9-2002/3).</p> <p>Greylag goose, <i>Anser anser anser</i>, Iceland/UK, Ireland 1007 individuals, representing an average of 1.1% of the population (Source period not collated).</p>

86. All international statutory designated sites for nature conservation are considered to be of high importance.

23.6.2 National Statutory Designated Sites

87. A total of 17 national statutory designated sites for nature conservation are located within the designated sites study area. Eleven of these sites are not afforded protection for their ornithological interest and therefore will not be considered further. The remaining six sites are notified or designated in part due to the breeding or wintering bird species they support. These six sites are:
- River Wensum SSSI;
 - Dereham Rush Meadow SSSI;
 - Dillington Carr, Gressenhall SSSI;
 - Cawston and Marsham Heaths SSSI;
 - Booton Common SSSI; and
 - Pigney's Wood LNR.
88. One of these sites, the River Wensum SSSI is also located directly within the onshore project area. Pigney's Wood LNR is also located immediately adjacent to the onshore project area.
89. Table 23.12 lists the six statutory designated sites that are located within the designated sites study area. This table also provides a summary of the reasons for the designation of these sites. The legislation underpinning statutory designated

sites is discussed in section 23.2.1. The locations of these statutory designated sites are shown on Figure 22.2 in Chapter 22 Onshore Ecology.

90. All national statutory designated sites for nature conservation are considered to be of high importance.

Table 23.12 National designated sites for nature conservation of relevance to onshore ornithology

Name	Designation	Location (NGR) / size (ha)	Distance to onshore project area at their closest point	Qualifying features/reasons for notification
River Wensum	SSSI	TF 942246 to TG 250078 306.79	Located within	<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.</p> <p>Ornithological interest features: Kingfisher <i>Alcedo atthis</i> and little grebe <i>Tachybaptus ruficollis</i> breed along the River, whilst the adjacent wetlands have good populations of reed warblers <i>Acrocephalus scirpaceus</i>, sedge warblers <i>Acrocephalus schoenobaenus</i> and barn owls <i>Tyto alba</i>.</p> <p>Extensive areas of reedbed and tall mixed fen communities have developed which provide valuable breeding and hunting grounds for birds such as the barn owl <i>Tyto alba</i> and hen harrier <i>Circus cyaneus</i>.</p>
Dereham Rush Meadow	SSSI	TF 976140 20.6	300m south	<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.</p> <p>Ornithological interest features: The site is of interest for its breeding bird population including snipe <i>Gallinago gallinago</i>, lapwing <i>Vanellus vanellus</i>, sedge warbler and reed warbler, and winter floods are periodically used by waterfowl.</p>
Dillington Carr, Gressenhall	SSSI	TF 971158 49.0	300m north	<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.</p> <p>Ornithological interest features: The freshwater habitats support a wide range of breeding birds including gadwall, pochard, teal, tufted duck, shoveler, great crested grebe and kingfisher. The surrounding woodland is also rich in breeding species, the more notable being barn owl, little owl <i>Athene noctua</i>, lesser spotted woodpecker <i>Dryobates minor</i>, willow tit <i>Poecile montanus</i>, nuthatch <i>Sitta europaea</i>, nightingale <i>Luscinia megarhynchos</i> and garden warbler <i>Sylvia borin</i>.</p>
Cawston and Marsham Heaths	SSSI	TG 170235 125.7	1.5km south	<p>Cawston and Marsham Heaths form the largest area of heather-dominated heathland now remaining in east Norfolk.</p>

Name	Designation	Location (NGR) / size (ha)	Distance to onshore project area at their closest point	Qualifying features/reasons for notification
				Ornithological interest features: A wide variety of heathland birds nest on the site including tree pipits <i>Anthus trivialis</i> , whinchats <i>Saxicola rubetra</i> and occasional nightjars <i>Caprimulgus europaeus</i> and the site is important as a winter roost for hen harriers. ³
Booton Common	SSSI	TG 113230 7.73	700m south	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. Ornithological interest features: A variety of breeding birds are present including snipe, woodcock <i>Scolopax rusticola</i> , grasshopper warbler <i>Locustella naevia</i> and lesser whitethroat <i>Sylvia curruca</i> .
Pigney's Wood	LNR	TG295319 20.87	Located adjacent	Pigney's Wood is a woodland site with reedbeds, a scrape, and wildflowers, butterflies, trees and birds.

³ Consultation with Norfolk Wildlife Trust confirmed that the hen harrier winter roost at Cawston and Marsham Heaths is no longer active (Norfolk Wildlife Trust, 2016)

23.6.3 Non-statutory Designated Sites

91. A total of 95 non-statutory designated sites (CWS and RNR) have been identified within the designated sites study area, as shown on Figure 22.3 in Chapter 22 Onshore Ecology. Five sites are located directly within the onshore project area and have potential ornithological interest(s). 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).
92. Of the remaining ninety sites, seven are located adjacent to the onshore project area, 11 are located within 300m of the onshore project area and the remaining sites are located between 300m and 2km from the onshore project area.
93. In addition, there is a proposed CWS which, if it is designated, will be located within the onshore project area at Kerdiston between Kerdiston Hall and the Marriott's Way ('Kerdiston Old Hall Meadows'). This site has potential ornithological interest in its grassland and hedgerow areas.
94. All non-statutory designated sites are considered to be of medium importance.

23.6.4 Terrestrial Habitats

95. 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 in Chapter 22 Onshore Ecology, 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).

23.6.4.1 Woodland

96. 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.

97. Lowland mixed deciduous woodland, wet woodland, and wood-pasture and parkland are also listed as Priority Habitats on the Norfolk LBAP.
98. There are approximately 8.3ha of woodland habitat located within the onshore project area (see Figure 22.5 in Chapter 22 Onshore Ecology), 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).
99. 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 in Chapter 22 Onshore Ecology). Land at Dillington Carr (TN158) is also transitional wet woodland habitat.
100. Typical semi-natural woodland composition recorded during the 2017 Extended Phase 1 Habitat Survey 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*.
101. 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*.
102. Small areas found during the 2017 and 2018 Extended Phase 1 Habitat Surveys were classified as wood-pasture and parkland, typically where oak standards in hedgelines had become overgrown and remained after the hedgeline had been removed.
103. All woodland habitats have the potential to support common or notable breeding birds.

23.6.4.2 Scrub

104. Approximately 0.8ha of scrub habitat (both continuous and in scattered parcels) is located throughout the onshore project area (see Figure 22.5 in Chapter 22 Onshore Ecology). These 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.
105. All areas of scrub have the potential to support common or notable breeding birds.

23.6.4.3 Isolated trees

106. 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 within private residential gardens.
107. 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 in Chapter 22 Onshore Ecology).
108. All isolated trees have the potential to support common or notable breeding birds.

23.6.4.4 Hedgerows

109. Hedgerows are both UKHPI and Norfolk LBAP priority habitats.
110. A total of 355 hedgerows were recorded within the species study area during the 2017 and 2018 Extended Phase 1 Habitat Surveys, 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 in Chapter 22 Onshore Ecology).
111. Of the 143 hedgerows recorded within the onshore project area during the 2017 and 2018 Extended Phase 1 Habitat Surveys, 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.
112. 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, 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.
113. All hedgerows have the potential to support common or notable breeding birds.

23.6.4.5 Unimproved and semi-improved grassland

114. No areas of unimproved grassland were recorded within the species study area.
115. 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).

116. 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.
117. No species-rich grasslands were noted during the 2017 and 2018 Extended Phase 1 Habitat Surveys.
118. All semi-improved grassland has the potential to support common and notable wintering / on passage birds as roosting, feeding and loafing sites, and to support notable ground-nesting breeding birds.

23.6.4.6 Marshy grassland

119. Marshy grassland was recorded within 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).
120. 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*.
121. 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 in Chapter 22 Onshore Ecology).
122. All marshy grassland has the potential to support common and notable wintering / on passage birds for roosting, feeding and loafing opportunities. This habitat is also suitable to support notable ground-nesting breeding birds.

23.6.4.7 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 Survey, and a further seven areas were identified from the Norfolk 'Living Map' (see Figure 22.5 in Chapter 22 Onshore Ecology) 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.*

124. Improved grassland has the potential to support common and notable wintering / on passage birds as roosting, feeding and loafing sites, although it is not an optimal habitat for this function.

23.6.4.8 Tall ruderal vegetation

125. Localised areas of tall ruderal habitat were recorded within the species study area during the 2017 and 2018 Extended Phase 1 Habitat Survey (see Figure 22.5 in Chapter 22 Onshore Ecology). 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.

23.6.4.9 Standing water

126. Ponds are a UKHPI and Norfolk LBAP priority habitat.
127. There are a total of 206 standing water bodies (i.e. ponds, lakes, ditches) located within the great crested newt study area⁴, of which six are located within the onshore project area (see Figure 22.5 in Chapter 22 Onshore Ecology). Standing water accounts for approximately 0.7ha (0.2%) of habitat within the onshore project area.
128. All standing water has the potential to support common and notable wintering / on passage birds as feeding and loafing sites, and common breeding birds along pond edges.

23.6.4.10 Running water

129. Rivers are a UKHPI; they 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.

⁴ Within 250m of the temporary onshore project area and within 500m of the permanent onshore project area (Figure 22.5 in Chapter 22 Onshore Ecology).

132. All running water has the potential to support common and notable wintering / on passage birds as feeding and loafing sites, and common breeding birds along river margins.

23.6.4.11 Coastal habitats

133. 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.

134. All coastal grassland and intertidal sand habitats have the potential to support common and notable wintering / on passage birds.

23.6.4.12 Other habitats

23.6.4.12.1 Arable land

135. The largest habitat by area within the species study area is arable land (382ha). This equates to approximately 87% of the onshore project area.

136. All arable land, in particular arable field margins, has the potential to support notable wintering / on passage birds as feeding and loafing sites. Arable land also has the potential to support certain notable ground-nesting breeding birds.

23.6.4.12.2 Buildings

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

138. Certain buildings with open roof cavities or flat roofs have the potential to support notable breeding or roosting birds (for example, barn owl, or gull species).

23.6.4.13 Summary

139. Table 23.13 summarises the footprints of each habitat type described in section 23.6.4. The totals below are the combined totals derived from the 2017 and 2018 Extended Phase 1 Habitat Survey and the Norfolk Living Map, unless otherwise specified.

Table 23.13 Habitat footprints within the onshore project area (blue shading indicates potential of habitat to support breeding / wintering birds)

Habitat type	Area (ha)	% of onshore project area	Potential to support common or notable breeding birds	Potential to support common or notable wintering / on passage birds
Lowland mixed deciduous woodland	0.6	0.1%	Yes	No
Broadleaved semi-natural woodland	3.6	0.8%	Yes	No
Broadleaved plantation woodland	0.6	0.1%	Yes	No
Coniferous plantation woodland	3.0	0.7%	Yes	No
Mixed plantation woodland	0.5	0.1%	Yes	No
Dense/continuous scrub	0.7	0.2%	Yes	No
Scattered scrub	0.1	<0.1%	Yes	No
Broadleaved parkland / scattered trees	<0.1	<0.1%	Yes	No
Improved grassland	9.1	2.1%	Yes	Yes
Marshy grassland	12.8	2.9%	Yes	Yes
Coastal and floodplain grazing marsh	0.1	<0.1%	Yes	Yes
Semi-improved grassland	3.3	0.8%	Yes	Yes
Poor semi-improved grassland	6.4	1.4%	Yes	Yes
Tall ruderal	0.1	<0.1%	Yes	Yes
Standing water	0.7	0.2%	Yes	Yes
Running water	0.7	0.2%	Yes	Yes
Cultivated / disturbed land - arable	382.1	86.7%	Yes	Yes
Cultivated / disturbed land - amenity grassland	0.7	0.2%	No	Yes
Gardens	0.5	0.1%	Yes	Yes
Bare ground	1.3	0.3%	No	No
Urban	6.5	1.5%	No	No
Other habitat	<0.1	<0.1%	No	No
Intertidal mud / sand	6.3	1.4%	No	Yes
Dune grassland	0.8	0.2%	No	Yes
Beach	<0.1	<0.1%	No	Yes
Maritime Cliff and Slopes	<0.1	<0.1%	No	Yes

23.6.5 Bird Species

140. This section provides a summary of the bird species recorded within the species study area during the ornithological surveys that have been undertaken to date. The baseline presented here draws on information provided by NBIS and Natural England, the findings of the 2017 and 2018 Extended Phase 1 Habitat Surveys, the findings of the Wintering Bird Survey (October 2016 – March-2017) and the findings from the Breeding Bird Survey (May 2017 – August 2017). The background to these surveys is presented in Appendix 23.1, and the full results of these surveys to date are presented in Appendix 23.2 and in Appendix 22.5 in Chapter 22 Onshore Ecology.

23.6.5.1 Wintering / on passage bird species

141. A desk-based scoping exercise was undertaken in August 2016 to identify those habitats which may support wintering / on passage bird species associated with statutory designated sites for nature conservation (Onshore Winter / Passage Bird Survey Scoping Report (Appendix 23.1). This assessment identified both in-situ and ex situ habitats⁵ that have the potential to support the ornithological interest features of all internationally designated sites within 5km of the Norfolk Vanguard project scoping area⁶ and nationally designated sites within 1km of the scoping area. As such a suite of wintering bird surveys focussing on these habitats and areas was undertaken, the scope of which were agreed with Natural England as part of the EPP. These surveys focussed on wintering bird species rather than on passage species as the relevant designated sites within the Norfolk Vanguard scoping area (Broadland SPA and Ramsar site and Dereham Rush Meadow) are designated for wintering rather than on passage qualifying features. Results from the surveys are shown on Figures 23.2 – 23.5.

142. As part of the site selection process for the project, the Norfolk Vanguard scoping area was revised into a more detailed development footprint in December 2016⁷. Following this, the scope of the wintering bird surveys was revised to only include those habitats with the potential to support the ornithological interest features of all internationally designated sites within 5km and nationally designated sites within 1km of the revised development footprint. Therefore, the data for the full survey period, October – March, was collected for the following habitats:

⁵ Ex situ habitats are those habitats located outside the boundary of an internationally designated site boundary which support features of the relevant designated site.

⁶ The project scoping area was used as this assessment was undertaken early in the Norfolk Vanguard design development process when more detailed onshore project area had not yet been determined, and was used to inform the site selection process.

⁷ This more detailed development footprint was further revised into the onshore project area (as presented in section 23.5.1) in August 2017, however given this revision occurred once the wintering bird surveys were completed, it is the more detailed development footprint upon which the wintering bird surveys were based.

- Agricultural land within 5km of the Broadland SPA and Ramsar site, and also within – or within a precautionary 1km disturbance buffer of – the onshore project area;
- Coastal habitats within 5km of the Broadland SPA and Ramsar site, and also within – or within a precautionary 1km disturbance buffer of – the onshore project area;
- Lowland fen, rivers and lakes and lowland heathland habitats of the Hundred Stream within 5km of the Broadland SPA and Ramsar site, and also within – or within a precautionary 1km disturbance buffer of – the onshore project area; and
- Habitats within the boundaries of the Dereham Rush Meadows SSSI.

143. The findings of the wintering bird surveys of these habitats are summarised in the following section, and a full copy of the survey report can be found in Appendix 23.1.

23.6.5.1.1 Agricultural fields in North Walsham District

144. All agricultural habitats (i.e. pasture and arable) within 5km of the Broadland SPA and Ramsar site were surveyed for their potential to support wintering populations of qualifying features of the Broadland SPA. These habitat areas were identified by the Onshore Wintering / Passage Bird Survey Scoping Report (Appendix 23.1) and are shown on Figure 23.2.

Table 23.14 Agricultural fields in North Walsham District: Peak count of waterbird species across six visits

Importance	Visit 1 11/11/2016	Visit 2 29/11/2016	Visit 3 15/12/2016	Visit 4 10/01/2017	Visit 5 07/02/2017	Visit 6 02/03/2017
Golden plover <i>Pluvialis apricaria</i>	-	-	-	-	-	120
Lapwing	-	-	-	-	-	197
Black-headed gull <i>Chroicocephalus ridibundus</i>	-	-	-	-	28	192
Common gull <i>Larus canus</i>	-	-	-	-	23	74

145. The counts of waterbirds recorded during the survey are not of a scale to be of national (or greater) importance (i.e. less than 1% of the Great Britain or international population) or to be a significant component of the Broadland SPA or its constituent SSSIs.

146. Flocks of pink-footed geese were observed in flight during the surveys, but no evidence to confirm their roosting, foraging or loafing was noted within the internationally designated sites study area. The peak size of these mobile flocks estimated as approximately 2,000 individuals.

23.6.5.1.2 Dereham Rush Meadow SSSI

147. The Dereham Rush Meadow SSSI was surveyed to provide data on the wintering bird resource at this site. This site is located 300m south of the onshore project area. This site was identified for detailed survey by the Onshore Wintering / Passage Bird Survey Scoping Report (Appendix 23.1). The location of this site and survey results are shown on Figure 23.3.

Table 23.15 Dereham Rush Meadow SSSI: Peak count of waterbird species across six visits

Species	Visit 1 11/11/2016	Visit 2 30/11/2016	Visit 3 16/12/2016	Visit 4 12/01/2017	Visit 5 07/02/2017	Visit 6 02/03/2017
Egyptian Goose <i>Alopochen aegyptiaca</i>	-	2	-	-	-	2
Teal	-	-	3	-	-	-
Mallard <i>Anas platyrhynchos</i>	4		5	-	4	-
Little Egret <i>Egretta garzetta</i>	-	1	1	2	3	-
Grey Heron <i>Ardea cinerea</i>	-	1	-	1	-	-
Water Rail <i>Rallus aquaticus</i>	1	-	2	2	-	2
Moorhen <i>Gallinula Chloropus</i>	-	-	-	-	2	1
Snipe		1	1	-	-	-
Black-headed Gull	29	23	32	77	64	62
Common Gull	3	2	1	5	32	6
Lesser Black-backed Gull <i>Larus fuscus</i>	-	-	-	1	-	-
Herring Gull <i>Larus argentatus</i>	-	1	3	6	-	5
Pied Wagtail <i>Motacilla alba</i>	1	2	-	-	-	-

Species	Visit 1 11/11/2016	Visit 2 30/11/2016	Visit 3 16/12/2016	Visit 4 12/01/2017	Visit 5 07/02/2017	Visit 6 02/03/2017
Grey Wagtail <i>Motacilla cinerea</i>	1	-	1	-	-	-
Meadow Pipit <i>Anthus pratensis</i>	9	-	1	-	-	2
Reed Bunting <i>Emberiza schoeniclus</i>	-	-	3	3	1	-

148. The counts of waterbirds recorded during the survey are not of a scale to be of national (or greater) importance (i.e. less than 1% of the Great Britain or international population) or to be a significant component of the Dereham Rush Meadow SSSI.
149. The gulls recorded during the Dereham Rush Meadow SSSI survey were largely associated within the nearby sewage treatment works.

23.6.5.1.3 Hundred Stream

150. Reedbed, lowland fen, rivers and lakes and lowland heathland within 5km of the Broadland SPA and Ramsar site were surveyed for their potential to support wintering populations of qualifying features of the Broadland SPA. These habitats areas were identified along the Hundred Stream by the Onshore Wintering / Passage Bird Survey Scoping Report (Appendix 23.1), and are shown on Figure 23.4.

Table 23.16 Habitats along the Hundred Stream: Peak count of waterbird species across six visits

Species	Visit 1 10/11/2016	Visit 2 29/11/2016	Visit 3 15/12/2016	Visit 4 10/01/2017	Visit 5 07/02/2017	Visit 6 02/03/2017
Pink-footed Goose	-	-	75	-	-	-
Mallard	-	2	-	4	-	3
Black-headed Gull	-	-	47	1	4	2

151. Flocks of pink-footed geese were observed in flight during the surveys, but no evidence of them roosting, foraging or loafing was noted.
152. The counts of waterbirds recorded during the survey are not of a scale to be of national (or greater) importance (i.e. less than 1% of the Great Britain or international population) or to be a significant component of the Broadland SPA or its constituent SSSIs.

23.6.5.1.4 North Norfolk Coast between Eccles-on-Sea and Paston

153. Coastal habitats within 5km of the Broadland SPA and Ramsar site were surveyed for their potential to support wintering populations of qualifying features of the Broadland SPA. These habitats areas were identified along the coast between Eccles-on-Sea and Paston by the Onshore Wintering / Passage Bird Survey Scoping Report (Appendix 23.1) and are shown on Figure 23.5.

Table 23.17 North Norfolk Coast between Eccles-on-Sea and Paston: Peak count of waterbird species (and other species) across six visits

Species	Visit 1 31/10/2016 01/11/2016	Visit 2 28/11/2016	Visit 3 14/12/2016	Visit 4 11/01/2017	Visit 5 08/02/2017	Visit 6 01/03/2017
Red-throated Diver <i>Gavia stellata</i>	5	11	3	16	14	17
Black-throated Diver <i>Gavia arctica</i>	-	-	1	1	2	-
Great Northern Diver <i>Gavia immer</i>	-	-	-	1	-	-
Great Crested Grebe	-	1	-	-	-	-
Cormorant	15	-	-	-	-	6
Gannet <i>Morus bassanus</i>	2	1	-	2	7	70
Dark-bellied Brent Goose <i>Branta bernicla</i>	4	-	1	-	-	-
Wigeon	-	-	11	-	-	-
Teal	14	-	-	-	-	-
Mallard	-	2	4	-	-	-
Shoveler	-	-	1	-	-	-
Eider <i>Somateria mollissima</i>	-	11	-	-	-	-
Common Scoter <i>Melanitta nigra</i>	14	53	-	3	15	-
Goldeneye <i>Bucephala clangula</i>	4	-	-	-	-	-
Red-breasted Merganser <i>Mergus serrator</i>	-	4	-	-	-	-
Kestrel <i>Falco tinnunculus</i>	-	1	-	-	-	-
Oystercatcher <i>Haematopus ostralegus</i>	-	-	-	2	-	3
Ringed Plover <i>Charadrius hiaticula</i>	-	8	12	1	5	3
Sanderling <i>Calidris alba</i>	-	7	2	3	2	-
Dunlin	-	2	-	-	-	-

Species	Visit 1 31/10/2016 01/11/2016	Visit 2 28/11/2016	Visit 3 14/12/2016	Visit 4 11/01/2017	Visit 5 08/02/2017	Visit 6 01/03/2017
<i>Calidris alpina</i>						
Purple Sandpiper <i>Calidris maritima</i>	-	1	-	-	-	-
Turnstone <i>Arenaria interpres</i>	30	38	26	26	29	49
Mediterranean Gull <i>Ichthyaetus melanocephalus</i>	1	2	2	1	2	2
Little Gull <i>Hydrocoloeus minutus</i>	-	-	-	1	-	-
Black-headed Gull	1,479	1,269	3,530	189	143	664
Common Gull	256	500	1,106	26	54	207
Lesser Black-backed Gull	4	7	1	1	2	3
Herring Gull	150	355	172	125	110	218
Great Black-backed Gull <i>Larus marinus</i>	110	568	79	41	16	47
Glaucous Gull <i>Larus hyperboreus</i>	-	-	-	-	2	-
Kittiwake <i>Rissa tridactyla</i>	-	-	-	-	-	8
Guillemot <i>Uria aalge</i>	10	7	16	20	10	1
Razorbill <i>Alca torda</i>	-	2	2	2	2	-
Puffin <i>Fratercula arctica</i>	-	-	-	1	-	-
Auk sp.	1	-	-	1	-	-
Great Skua <i>Stercorarius skua</i>	1	2	-	-	-	1
Kingfisher	-	2	-	-	-	-
Carrion Crow <i>Corvus corone</i>	13	3	11	8	8	8
Jackdaw <i>Corvus monedula</i>	8	-	1	-	-	-
Pied Wagtail	1	2	8	5	2	11
Meadow Pipit	-	2	3	-	-	3
Rock Pipit <i>Anthus petrosus</i>	-	-	-	-	-	2
Wren <i>Troglodytes troglodytes</i>	-	-	1	-	-	-
Stonechat <i>Saxicola rubicola</i>	-	1	-	-	-	-
Black Redstart <i>Phoenicurus ochrurus</i>	1	-	-	-	-	-
Starling <i>Sturnus vulgaris</i>	-	42	8	16	27	48
Snow Bunting	1	7	-	-	-	-

Species	Visit 1 31/10/2016 01/11/2016	Visit 2 28/11/2016	Visit 3 14/12/2016	Visit 4 11/01/2017	Visit 5 08/02/2017	Visit 6 01/03/2017
<i>Plectrophenax nivalis</i>						
House Sparrow <i>Passer domesticus</i>	-	-	1	-	-	1

154. The counts of waterbirds recorded during the survey are not of a scale to be of national (or greater) importance (i.e. less than 1% of the Great Britain or international population) or to be a significant component of the Broadland SPA or its constituent SSSIs.

23.6.5.2 Breeding bird species

23.6.5.2.1 Breeding bird surveys

155. Selected areas were identified during the 2017 and 2018 Extended Phase 1 Habitat Surveys as being suitable to support populations of breeding birds of conservation importance. The following criteria were used to scope in suitable habitats for supporting breeding birds:

- Statutory designated sites with notified breeding bird species located within a precautionary 1km buffer of the onshore project area;
- Non-statutory designated sites which support breeding birds located within the onshore project area; and
- UKHPI suitable to support breeding bird species located within the onshore project area.

156. Following these scoping guidelines, the following sites were identified for further bird surveys:

- Booton Common SSSI;
- Dillington Carr, Gressenhall SSSI;
- Dereham Rush Meadows SSSI;
- River Wensum SSSI;
- Land South of Dillington Carr CWS;
- Pigney's Wood LNR;
- Floodplain grazing marsh UKHPI adjacent to the River Wensum; and
- Floodplain grazing marsh and lowland fen UKHPI adjacent to North Walsham and Dilham Canal.

157. The locations of these areas are shown in Appendix 23.2 and Figure 23.6. These locations have been surveyed for breeding birds, with surveys completed in August 2017. Table 23.18 summarises the results of these surveys. The floodplain grazing marsh habitat at the River Wensum and the River Wensum SSSI were surveyed

together, as were Pigney's Wood and floodplain grazing marsh habitat at North Walsham and Dilham Canal.

Table 23.18 2017 Breeding Bird Survey results

Location	Survey dates	Total number of species recorded	Total number of species holding territories	Species of note ⁸
Dereham Rush Meadows BB01	Five survey visits between May (2 visits) and August	35	21	Bullfinch (BOCC, Amber) Dunnock (BOCC, Amber) Reed bunting (BOCC, Amber; LBAP) Reed warbler (SSSI) Song thrush <i>Turdus philomelos</i> (BOCC, Red; LBAP) Willow warbler <i>Phylloscopus trochilus</i> (BOCC, Amber)
Dillington Carr BB02	Five survey visits between May (2 visits) and August	47	30	Coot (SSSI) Cuckoo <i>Cuculus canorus</i> (BOCC, Red) Dunnock (BOCC, Amber) Gadwall (BOCC, Amber; SSSI) Great-crested grebe (SSSI) Little grebe (SSSI) Mallard (BOCC, Amber) Mistle thrush (BOCC, Red) Moorhen (SSSI) Mute swan <i>Cygnus olor</i> (BOCC, Amber; SSSI) Reed bunting (BOCC, Amber; LBAP) Song thrush (BOCC, Red; LBAP) Stock dove (BOCC, Amber)
Booton Common BB03	Five survey visits between May (2 visits) and August	29	21	Dunnock (BOCC, Amber) Marsh tit (BOCC, Red) Song thrush (BOCC, Red; LBAP)
Pigney's Wood BB04	Five survey visits between May (2 visits) and August	38	26	Cuckoo (BOCC, Red) Dunnock (BOCC, Amber) Mute swan (BOCC, Amber) Reed bunting (BOCC, Amber; LBAP) Song thrush (BOCC, Red; LBAP) Stock dove <i>Columba oenas</i> (BOCC, Amber)
Land south of Dillington Carr BB05	Five survey visits between May (2 visits) and August	41	29	Bullfinch (BOCC, Amber) Dunnock (BOCC, Amber) Reed bunting (BOCC, Amber; LBAP) Reed warbler (SSSI) Song thrush (BOCC, Red; LBAP) Willow warbler (BOCC, Amber)
River Wensum	Five survey visits	42	33	Barn owl (Schedule 1; SSSI; LBAP) Bullfinch (BOCC, Amber)

⁸ BOCC Amber = Amber listed species on Birds of Conservation Concern 4 (Eaton et al., 2015).

BOCC Red = Red listed species on Birds of Conservation Concern 4 (Eaton et al., 2015).

SSSI = notified feature of the surveyed SSSI

LBAP = Species subject to a Norfolk LBAP

Schedule 1 = Species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended)

Location	Survey dates	Total number of species recorded	Total number of species holding territories	Species of note ⁸
Floodplain BB06	between May and August (note: 2 visits were undertaken in June)			Cuckoo (BOCC, Red) Dunnock (BOCC, Amber) Great spotted woodpecker Kestrel (BOCC, Amber) Linnet (BOCC, Red) Mallard (BOCC, Amber) Mute swan (BOCC, Amber) Reed Bunting (BOCC, Amber; LBAP) Skylark (BOCC, Red; LBAP) Song Thrush (BOCC, Red; LBAP) Stock Dove (BOCC, Amber)

158. No birds listed on Schedule 1 of the Wildlife and Countryside Act as amended (1981) have been recorded nesting within the survey area.

23.6.5.2.2 Other species recorded within the onshore project area

159. A number of notable bird species were also recorded in the onshore project area along the onshore cable route during the 2017 and 2018 Extended Phase 1 Habitat Surveys. Wader species were observed at five locations within the species study area. Species observed included snipe, common sandpiper and woodcock, of which the latter is a BoCC4 Red List species. Woodcock was observed within hedgerows at TN313 and TN394, while snipe and common sandpiper were observed in wet grassland habitat at TN148, TN205 and TN233 (see Figure 22.5 in Chapter 22 Onshore Ecology).

160. BoCC4 Red List species skylark, starling and lapwing were observed during the field survey. Skylarks were observed in songflight over arable fields in 13 locations within the onshore survey area. Murmurations of starling were observed in and around the onshore survey area and a flock (approximately 200 in number) of lapwing were observed loafing in an arable field at TN166 (see Figure 22.5 in Chapter 22 Onshore Ecology). These BoCC4 red list species present throughout the arable habitats of the onshore project area are receptors of medium importance.

161. Woodpecker were heard drilling in two locations within the species study area, and woodpecker holes were observed in a further five locations. No individuals were observed in order to confirm which woodpecker species. Lesser spotted woodpecker is a BoCC4 Red List species. Two owl nests were also observed at TN326 and TN329, although the species was not confirmed, they are likely to be barn owl (a species listed on Schedule 1 of the Wildlife and Countryside Act 1981 (as amended)) (see Figure 22.5 in Chapter 22 Onshore Ecology).

162. A number of other bird species (all of which are common species) were also observed during the 2017 and 2018 Extended Phase 1 Habitat Surveys including egret, goldfinch *Carduelis carduelis*, cormorant, robin *Erithacus rubecula*, chaffinch *Fringilla coelebs*, siskin *Spinus spinus*, long tailed tit *Aegithalos caudatus*, blue tit *Cyanistes caeruleus*, great tit *Parus major*, blackbird *Turdus merula*, bullfinch, wren, woodpigeon *Columba palumbus*, rook *Corvus frugilegus*, buzzard *Buteo buteo*, herring gull, kestrel, Egyptian goose, goldcrest *Regulus regulus*, tree creeper *Certhia familiaris* and tawny owl *Strix aluco*. Common bird species are considered to be a receptor of low importance.
163. All hedgerows, parkland, isolated trees and woodland (all types) habitats were identified as potentially providing suitable nesting habitat for common species nesting birds. The wet grassland observed adjacent to the River Bure, River Wensum and North Walsham and Dilham Canal may also provide suitable breeding habitat for wader species including snipe. Arable fields provide habitat for breeding skylark.
164. A review of the Norfolk Living Map dataset and the 2017 aerial survey data identified 31 additional locations which may support common nesting or foraging birds within areas which were not accessible during the 2017 Extended Phase 1 Habitat Survey. Of these, 29 locations were identified as providing potential nesting habitat for common bird species, and one was identified as potentially providing suitable habitat for waders and wildfowl (Coastal flooding plain grazing marsh on the left-hand bank of the River Wensum). These are shown on Figure 22.5 in Chapter 22 Onshore Ecology.
165. A sand martin nesting colony, a common breeding bird, has also been recorded along the coast at Happisburgh.
166. Advice from Natural England during the EPP indicated that the River Wensum floodplain on the southern (right hand) bank of the river within the species study area is currently subject to a Countryside Stewardship to target wintering waders and wildfowl. Consequently, Natural England advised that for this area it should be presumed that such species are present between November and February inclusive.

23.6.5.3 Conservation importance of receptors

167. The conservation importance of those wintering / on passage (non-breeding) receptors which have been identified in section 23.6.5.1 as potentially being impacted by the project is summarised in Table 23.19. The conservation importance for each receptor at the scale of the onshore project area has been determined following the approach described in section 23.4.1.1.

Table 23.19 Conservation status of wintering / on passage birds

Species	Peak count (waterbirds)	Population 1% thresholds		Conservation Status	Conservation importance for onshore project area	Comments
		GB	Int'l			
Red-throated Diver	17	2,600	170	Annex 1	Low	Numbers recorded well below GB threshold
Black-throated Diver	2	3,500	6	Annex 1; BoCC4 Amber	Low	Numbers recorded well below GB threshold
Great Northern Diver	1	50	25	Annex 1; BoCC4 Amber	Low	Numbers recorded well below GB threshold
Great Crested Grebe	1	3,500	190		Negligible	No conservation status
Cormorant	15	350	1,200		Negligible	No conservation status
Gannet	70	-	-	BoCC4 Amber	Low	UK Amber list only
Dark-bellied Brent Goose	4	910	2,400	UKSPI [UK Species of Principal Importance]	Low	Numbers recorded well below GB threshold
Wigeon	11	15,000	4,400	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Teal	14	2,100	5,000	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Mallard	4	6,800	45,000	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Shoveler	1	400	180	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Eider	11	12,850	550	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Common Scoter	53	5,500	1,000	BoCC4 Red; UKSPI	Medium	Numbers recorded well below GB threshold; UK Red list
Goldeneye	4	11,400	200	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Red-breasted Merganser	4	1,700	84		Low	Numbers recorded well below GB threshold
Kestrel	N/A ⁹	N/A	N/A	BoCC4 Amber	Low	Numbers recorded well below GB threshold

⁹ Species recorded in observation during other field surveys. Species not observed during Breeding Bird Surveys, therefore no formal count taken.

Species	Peak count (waterbirds)	Population 1% thresholds		Conservation Status	Conservation importance for onshore project area	Comments
		GB	Int'l			
Oystercatcher	3	3,200	8,200	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Ringed Plover	12	340	730	BoCC4 Red; Norfolk LBAP	Medium	Numbers recorded well below GB threshold; UK Red list
Sanderling	7	1,200	160	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Dunlin	2	3,500	13,300	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Purple Sandpiper	1	710	130	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Turnstone	38	480	1,400	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Mediterranean Gull	2	18	770	Annex 1	Low	Numbers recorded well below GB threshold
Little Gull	1	-	1,100		Low	Numbers recorded well below Int'l threshold
Black-headed Gull	3,530	22,000	20,000	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Common Gull	1,106	7,000	16,400	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Lesser Black-backed Gull	7	1,200	5,500	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Herring Gull	355	7,300	10,200	BoCC4 Red; UKSPI	Medium	Numbers recorded well below GB threshold; UK Red list
Great Black-backed Gull	568	760	4,200	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Glaucous Gull	2	2,000	2	BoCC4 Amber	Medium	Numbers recorded well below GB threshold; Int'l threshold breached
Kittiwake	8	20,000	-	BoCC4 Red	Medium	Numbers recorded well below GB threshold; UK Red list
Guillemot	20	-	-	BoCC4 Amber	Low	UK Amber list only
Razorbill	2	-	-	BoCC4 Amber	Low	UK Amber list only

Species	Peak count (waterbirds)	Population 1% thresholds		Conservation Status	Conservation importance for onshore project area	Comments
		GB	Int'l			
Puffin	1	-	-	BoCC4 Amber	Low	UK Amber list only
Auk sp.	1	-	-		Negligible	No conservation status
Great Skua	2	-	-	BoCC4 Amber	Low	UK Amber list only
Kingfisher	N/A	N/A	N/A	Annex 1; BoCC4 Amber	Low	Numbers recorded well below GB threshold
Carrion Crow	N/A	N/A	N/A		Negligible	No conservation status
Jackdaw	N/A	N/A	N/A		Negligible	No conservation status
Pied Wagtail	N/A	N/A	N/A		Negligible	No conservation status
Meadow Pipit	N/A	N/A	N/A	BoCC4 Amber	Low	UK Amber list only
Rock Pipit	N/A	N/A	N/A		Negligible	No conservation status
Wren	N/A	N/A	N/A		Negligible	No conservation status
Stonechat	N/A	N/A	N/A		Negligible	No conservation status
Black Redstart	N/A	N/A	N/A	BoCC4 Red	Medium	UK Red list
Starling	N/A	N/A	N/A	BoCC4 Red; UKSPI	Medium	UK Red list
Snow Bunting	N/A	N/A	N/A	BoCC4 Amber	Low	UK Amber list only
House Sparrow	N/A	N/A	N/A	BoCC4 Red; UKSPI	Medium	UK Red list
Pink-footed goose	75	3,500	3,600	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Egyptian Goose	N/A	N/A	N/A		Negligible	No conservation status
Little Egret	3	1,300	45	Annex 1	Low	Numbers recorded well below GB threshold
Grey Heron	1	2,700	610		Negligible	No conservation status
Water Rail	2	10,000	-		Negligible	No conservation status
Moorhen	2	20,000	3,200		Negligible	No conservation status
Snipe	1	20,000	10,000	BoCC4 Amber	Low	Numbers recorded well below GB threshold
Grey Wagtail	N/A	N/A	N/A	BoCC4 Red	Medium	UK Red list
Reed Bunting	N/A	N/A	N/A	BoCC4 Amber; UKSPI, Norfolk LBAP	Low	UK Amber list only
Golden plover	120	9,300	4,000	Annex 1	Low	Numbers recorded well below GB threshold
Lapwing	197	20,000	6,200	BoCC4 Red; UKSPI	Medium	Numbers recorded well below GB

Species	Peak count (waterbirds)	Population 1% thresholds		Conservation Status	Conservation importance for onshore project area	Comments
		GB	Int'l			
						threshold; UK Red list

168. The conservation importance of those breeding receptors which have been identified in section 23.6.5.2 as potentially being impacted by the project is summarised in Table 23.20.
169. The conservation importance for each receptor at the scale of the onshore project area has been determined following the approach described in section 23.4.1.1.
170. Since the 2017 Breeding Bird Survey was undertaken, refinement of the onshore project area during the site selection process means that Booton Common SSSI, Dillington Carr SSSI and Dereham Rush Meadows SSSI are now located more than 300m from the onshore project area. Therefore, they have been scoped out as requiring further consideration and/or assessment. Conservation status has, however, been considered for the receptors recorded at Pigney's Wood (BB04), Land south of Dillington Carr (BB05), and Wensum Floodplain (BB06).

Table 23.20 Conservation status of breeding birds

Species	Peak count	Conservation Status	Conservation importance for onshore project area	Comments
Pigney's Wood BB04				
Cuckoo	4	BoCC4 Red	Medium	Recorded in low numbers
Dunnock	5	BoCC4 Amber	Low	Recorded in low numbers
Mute swan	1	BoCC4 Amber	Low	Recorded in low numbers
Reed bunting	0	BoCC4 Amber, LBAP	Low	Recorded in low numbers
Song thrush	4	BoCC4 Red, LBAP	Medium	Recorded in low numbers
Stock dove	5	BoCC4 Amber	Low	Recorded in low numbers
Land South of Dillington Carr BB05				
Bullfinch	4	BoCC4 Amber	Low	Recorded in low numbers
Dunnock	5	BoCC4 Amber	Low	Recorded in low numbers
Reed bunting	1	BoCC4 Amber, LBAP	Low	Recorded in low numbers
Reed warbler	0	SSSI	Low	Recorded in low numbers
Song thrush	4	BoCC4 Red, LBAP	Medium	Recorded in low numbers
Willow warbler	5	BoCC4 Amber	Low	Recorded in low numbers
River Wensum BB06				
Barn owl	1	Schedule 1; SSSI; LBAP	Low	Recorded in low numbers
Bullfinch	2	BoCC4 Amber	Low	Recorded in low numbers
Cuckoo	1	BoCC4 Red	Medium	Recorded in low numbers
Dunnock	2	BoCC4 Amber	Low	Recorded in low numbers

Species	Peak count	Conservation Status	Conservation importance for onshore project area	Comments
Great spotted woodpecker	4	-	Low	Recorded in low numbers
Kestrel	1	BoCC4 Amber	Low	Recorded in low numbers
Linnet	2	BoCC4 Red	Medium	Recorded in low numbers
Mallard	11	BoCC4 Amber	Low	Recorded in low numbers
Mute swan	8	BoCC4 Amber	Low	Recorded in low numbers
Reed bunting	3	BoCC4 Amber, LBAP	Low	Recorded in low numbers
Skylark	1	BoCC4 Red	Medium	Recorded in low numbers
Song thrush	1	BoCC4 Red, LBAO	Medium	Recorded in low numbers
Stock dove	1	BoCC4 Amber	Low	Recorded in low numbers

23.6.6 Biodiversity

171. 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 ornithological biodiversity most at risk of loss, isolation or degradation.

23.6.7 Anticipated Trends in Baseline Conditions

172. The ecological baseline described in the preceding sections provides a summary of the habitats and species present within the onshore study areas. In broad terms, the onshore study areas represent typical lowland UK habitat types largely comprised of arable farmland with hedgerows, 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.

173. 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). In particular, species of farmland environments have declined over the short and long term (Defra, 2017).

174. 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 law¹⁰, 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 species present within the study area may continue. As a consequence, it is assumed that the ornithological baseline within the study area will continue to change over time as measures to try and manage the decline in protected species continues.

23.7 Potential Impacts

175. The following sections describe the impacts upon those ornithological receptors described in section 23.6 predicted to arise as a result of the construction, operation and decommissioning phases of the project, following the methodology set out in section 23.4. 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.
176. This 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.
177. 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.

23.7.1 Embedded Mitigation

178. 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.

¹⁰ 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.

Embedding mitigation into the project design is a type of primary mitigation and is an inherent aspect of the EIA process.

179. 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.
180. The following sections outline the key embedded mitigation measures relevant for this assessment. These measures are presented in Table 23.21. Where embedded mitigation measures have been developed into the design of the project with specific regard to onshore ornithology, these are described in Table 23.22.

Table 23.21 Embedded mitigation

Parameter	Mitigation measures embedded into the project design	Notes
Project Wide		
Commitment to HVDC technology	<p>Commitment to HVDC technology minimises environmental impacts through the following design considerations;</p> <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 route required for the duct installation phase is reduced from approx. 300ha to 210ha; • 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 bays for Norfolk Boreas from 450 to 150; and • Reduces the number of drills needed at trenchless crossings (including landfall). 	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 deploy HVDC technology as the export system.
Site Selection	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 explanation see Chapter 4 Site Selection and Alternatives) for onshore project substations, Necton National Grid extension and associated infrastructure, a preference for the shortest route length (where practical) and developing construction methodologies to minimise potential impacts.	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

Parameter	Mitigation measures embedded into the project design	Notes
	<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>inform the site selection process (including 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>
Long HDD at landfall	<p>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.</p>	<p>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.</p>
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</p>	<p>The strategic approach to delivering Norfolk Boreas and Norfolk Vanguard in order to minimise environmental impacts has been a consideration from the outset.</p>

Parameter	Mitigation measures embedded into the project design	Notes
	a localised area and, in so doing, will contain the extent of potential impacts.	
Scenario 2		
Duct Installation Strategy	Under Scenario 2, the onshore cable duct installation strategy is to install ducts in sections a 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	Commitment to trenchless crossing techniques to minimise impacts to the following specific features; <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; • 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. 	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.

Table 23.22 Specific embedded mitigation for onshore ornithology

Parameter	Mitigation measures embedded for onshore ornithology	Notes
Designated sites	<p>Constraints mapping was undertaken prior to the publication of the Norfolk Vanguard EIA Scoping Report (Royal HaskoningDHV, 2016). This constraints mapping 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 site 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>	<p>More information can be found in Chapter 4 Site Selection and Assessment of Alternatives.</p>
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. 	<p>Further information on the route refinement process can be found in Chapter 4 Site Selection and Assessment of Alternatives.</p>
Hedgerow and watercourse crossings	<p>Under Scenario 2 the working width at hedgerow and watercourse crossings is 13m¹¹ (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 pull phase), the number of gaps required will be minimised as far as possible and will be no wider than 6m.</p>	<p>Further information can be found in Chapter 5 Project Description.</p>

¹¹ 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 ornithology	Notes
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, a running track will be required to pass through the CWS. This will be a 6m by up to 180m road located within the CWS. This is shown on Figure 22.3 in Chapter 22 Onshore Ecology.</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 workfront (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 cable route will be lost for the duration of the cable duct installation); • 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 pulling; 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 	<p>For further details on the construction approach and indicative programme, please see Chapter 5 Project Description.</p>

Parameter	Mitigation measures embedded for onshore ornithology	Notes
	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.

23.7.2 Outline Landscape and Environmental Management Strategy

181. 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 submission, 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.
182. 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.
183. As outlined in section 23.5.3, survey access for the full survey area 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 has applied a precautionary, non-specific approach along with a 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.
184. Chapter 29 Landscape and Visual Impact Assessment includes details of mitigation planting schemes for the proposed permanent works at the onshore project substation. These have been developed in consultation with Norfolk County Council, and the requirements will be included within the OLEMS.

23.7.3 Monitoring

185. 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 (DCO Requirement 24) (which will be based on the OLEMS). An outline CoCP has been submitted as part of the DCO application (document reference 8.1).

23.7.4 Worst Case

186. This EclA has used the Rochdale Envelope principle and assessed impacts against a defined project worst case assumptions.

187. This section sets out the worst case assumptions with respect to onshore ornithology. 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 23.6. Chapter 5 Project Description sets out the details of the project. Table 23.23 sets out those parameters which comprise the worst case assumptions for onshore ornithology under Scenario 1, and Table 23.24 sets out those parameters which comprise the worst case assumptions for onshore ornithology under Scenario 2.

Table 23.23 Worst case assumptions – Scenario 1

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	
	Maximum temporary works duration	20 weeks	
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 footprints include the running track and jointing pits.

Parameter	Worst case criteria	Worst case definition	Notes
	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/hardstanding 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	
Decommissioning	Method	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 operational noise levels are as set out within Chapter 25 Noise and Vibration.

Parameter	Worst case criteria	Worst case definition	Notes
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 assumption, 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 23.24 Worst case assumptions – Scenario 2

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	

Parameter	Worst case criteria	Worst case definition	Notes
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	Construction method	Open cut trenching and trenchless crossing methods	Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration.
	Maximum working width and length	35m and 60km	
	Onshore cable route maximum footprint	2,100,000m ²	Total duct installation footprint includes the onshore cable route footprint plus all associated works footprints (mobilisation areas, trenchless launch and reception sites).
	Total maximum duct installation footprint	2,452,500m ²	
	Gaps at hedgerow / other crossing points	13m ¹²	
	Maximum hedgerows to be removed	165 ¹³	
	Running track excavated material	108,000m ³	Cable pulling footprint include the running track and jointing pit.
	Trench excavated material	180,000m ³	
Cable pulling maximum footprint	85,500m ²		

¹² 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.

¹³ 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.

Parameter	Worst case criteria	Worst case definition	Notes
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 trenchless launch and reception sites	Assumes 16 pairs at 7,500m ² and 5,000m ²	Assumed to be up to 150m x 50m and 100m x 50m
Construction programme - ducting	Ducting at any 150m workfront Trenchless works at each watercourse Running track Total construction window	2 weeks 8 weeks 2 years 2 years	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.
Construction programme - cable pulling works	Hardstanding area Running track Total construction window	10 weeks 16 weeks 2 years	In any one area per annum during the 2 year cable pulling phase.
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).

Parameter	Worst case criteria	Worst case definition	Notes
	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	75,000m ²	Operational footprint 250m x 300m
	Access	One visit per week, site lighting required during maintenance visits	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 assumption, 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). Indicative construction window 24 months Worst case construction noise levels are as set out within Chapter 25 Noise and Vibration.
	Maximum land take for temporary works area – overhead line	176,310m ²	
	Maximum duration	30 months	
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	

Parameter	Worst case criteria	Worst case definition	Notes
	Access	1 visit per month, site lighting required during maintenance visits	

188. Chapter 5 Project Description outlines the timings to be assessed in relation to the phasing of the works. In all cases for onshore ornithology; 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.

23.7.5 Potential Impacts during Construction

189. The potential impacts arising during the construction of the project is discussed in this section. The potential impacts arising from Scenario 1 and Scenario 2 are considered separately under each impact heading. Due to the fact that for the majority of impacts Scenario 2 represents the worst case due to the larger footprint of the works, this scenario is assessed first and then the reduced impacts under Scenario 1 are assessed second.

23.7.5.1 Impact 1: Designated sites

23.7.5.1.1 Scenario 2

Landfall

190. The Broadland SPA and Ramsar site is located approximately 4.5km from the landfall. As such, there is the potential for its ornithological qualifying features which have been recorded wintering on the coastal and arable ex situ habitats to be affected by the construction of the project.

191. The relative importance of each qualifying ornithological feature of the Broadland SPA and Ramsar site, based on its local population size, is summarised in Table 23.25. The importance of each qualifying feature is used to determine the overall significance of impact for each element of the onshore project area.

192. The following potential effects upon qualifying features of the Broadland SPA and Ramsar utilising ex situ habitats outside of the SPA and Ramsar boundary could arise during the construction phase:

- Medium term (i.e. over the duration of a single season), temporary habitat loss of approximately 0.6ha of arable habitat at the landfall HDD entry point for approximately 20 weeks; and
- Medium term, temporary visual, noise and light disturbance of bird species utilising arable or coastal habitats.

193. The effects are medium term, given the duration of the project construction phase. They do not however directly affect either a sensitive habitat or a habitat which is not abundant in the wider area, including the area within 5km of the Broadland SPA and Ramsar site. As such the magnitude of these effects is low.
194. The relative importance and the magnitude of effect against those qualifying features of the Broadland SPA and Ramsar site are summarised Table 23.25.

Table 23.25 Ornithological qualifying features of the Broadland SPA and Ramsar site

Species	Present in number exceeding the threshold (1%) of SPA / Ramsar site?	Importance	Greatest magnitude of effect under Scenario 2
Shoveler	No	Low	Medium
Wigeon	No	Low	Medium
Teal	No	Low	Medium
Great crested grebe	Assemblage only	Negligible	Medium
Cormorant	Assemblage only	Negligible	Medium
Pink-footed goose	No	Low	Medium

Onshore cable route

Broadland SPA and Ramsar site

195. Approximately 8ha of the cable route is located within a 5km buffer surrounding the Broadland SPA and Ramsar site. As such, there is the potential for ornithological qualifying features of the Broadland SPA and Ramsar site which have been recorded wintering on arable ex situ habitats to be affected by the project.
196. The relative importance of each ornithological qualifying feature of the Broadland SPA and Ramsar site, based on its local population size, is summarised in Table 23.25. The importance of each qualifying feature (along with the magnitude of effect) is used to determine the overall significance of impact for each element of the onshore project area.
197. The following potential effects upon the qualifying features of the Broadland SPA and Ramsar site utilising ex situ habitats outside of the SPA and Ramsar boundary are anticipated to arise during the construction phase:
- Long term, temporary habitat loss of approximately 7ha of arable habitat over approximately two years (duct installation), plus a further 16 weeks in any one area per annum during the two year cable pull element of the construction phase;
 - Long term, temporary habitat loss of approximately 1ha of improved grassland habitat over approximately two years (duct installation) plus a further 16 weeks

in any one area per annum during the two year cable pull element of the construction phase; and

- Long term, temporary visual, noise and light disturbance of bird species utilising arable habitats.

198. The effects are long term, given the duration of the project construction phase. They do not however affect either a sensitive habitat or a habitat which is not abundant in the wider area, including the area within 5km of the Broadland SPA and Ramsar site. As such the magnitude of these effects is considered to be medium (as per Table 23.25).

River Wensum SSSI

199. Approximately 0.75ha of the floodplain habitat adjacent to the River Wensum SSSI has been identified as supporting foraging barn owl, an interest feature of the SSSI. This species was not recorded breeding during the 2017 breeding bird surveys.

200. The relative importance of each ornithological qualifying feature of the SSSI, based on its local population size, is summarised in Table 23.20.

201. The following potential effects upon the interest features of the River Wensum SSSI are anticipated to arise during the construction phase:

- Short term, temporary habitat visual, noise and light disturbance during the 8 week duct installation phase within 300m of the floodplain habitats adjacent to the River Wensum.

202. Given the short-term, reversible nature of the effects on this species, the magnitude of these effects is low.

Pigney's Wood LNR and Land south of Dillington Carr CWS

203. Potential disturbance effects upon species (including bird species) present in these designated sites is considered in Chapter 22 Onshore Ecology. A potential effect of at most low magnitude was identified in relation to these sites.

Onshore project substation search area, National Grid substation extension and overhead line modifications

204. The onshore project substation, National Grid substation extension area and overhead line modifications area are located more than 5km from the Broadland SPA and Ramsar site and 2km from other designated sites. As such there will be no change upon statutory designated sites due to the proposed project onshore project substation, National Grid substation extension and overhead line modification works.

Road transport network

205. 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 provided in Chapter 26 Air Quality.
206. 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

207. No change upon statutory designated sites is anticipated from the onshore project substation, National Grid substation extension and overhead line modification works. There is the potential for effects on Broadland SPA and Ramsar site and its ornithological qualifying features as a result of works at the landfall and on the onshore cable route, of low to medium magnitude. There is also potential for effects on the ornithological interest features (barn owl) of the River Wensum SSSI of low magnitude.
208. As detailed above, without mitigation, the greatest magnitude of effect arising from the project is medium on a low importance receptor, resulting in an impact of at worst **minor adverse** significance.
209. The HRA Screening (Norfolk Boreas Limited, 2018) concluded that, given the distance of the Broadland SPA and Ramsar site from the onshore project area (4.5km), and as no qualifying ornithological features of either site had been recorded within the onshore project area at a scale of national or greater importance or at levels to qualify as a significant component of the Broadland SPA, concluded that no likely significant effect would occur. These findings were presented within the PEIR (Norfolk Boreas Limited, 2018) and this approach was agreed with stakeholders as part of the ETG meeting in February 2019. For further details see Chapter 22 Ecology Appendix 22.15.

Mitigation

210. The following mitigation is proposed in relation to designated sites:
- Adherence to JNCC's scheme to reduce disturbance to waterfowl during severe winter weather (available on the JNCC website (<http://jncc.defra.gov.uk/page->

2894)) during construction works at the landfall and along the onshore cable route in areas within 5km of the Broadland SPA and Ramsar site, including ceasing operations when temperatures drop below agreed criteria during the period 9th November to 20th February;

- All habitats which are temporarily lost during construction will be reinstated following completion of construction; and
- Best practice construction mitigation measures will be in place to minimise dust, noise and light emissions during construction. These measures are described in full in Chapter 25 Noise and Vibration and Chapter 26 Air Quality and secured in the OCoCP (Document reference 8.1).

211. These mitigation measures are captured within the OLEMS (Document reference: 8.7).

Impact following mitigation

212. The mitigation presented above will help ensure that the disturbance effects are reduced as far as possible. However, as a residual disturbance effect will still remain, the magnitude of effect on the low importance receptor will remain medium, resulting in a residual impact of **minor adverse** significance.

23.7.5.1.2 Scenario 1

Landfall

213. Under Scenario 1, the worst case assumptions for the proposed landfall works will be the same as under Scenario 2. As such, the impacts predicted will be the same (i.e. at most low magnitude).

Onshore cable route

Broadland SPA and Ramsar site

214. The Broadland SPA and Ramsar site is located within 5km of the onshore cable route. The 6m running track will be required during the cable pulling works. Although not all of the running track will be required during the cable pulling element of the construction phase, under a worst case assumption, the assessment assumes that all of it may be required within the areas located both within onshore cable route and a 5km buffer surrounding the Broadland SPA and Ramsar site. Therefore, approximately 1.5ha of land located within a 5km buffer surrounding the Broadland SPA and Ramsar site will be affected by the cable pulling works. As such, there is the potential for ornithological qualifying features of the Broadland SPA and Ramsar site which have been recorded wintering on arable ex situ habitats to be affected by the construction of the project.

215. The relative importance of each ornithological qualifying feature of the Broadland SPA and Ramsar site, based on its local population size, is summarised in Table 23.25. The importance of each qualifying feature (along with the magnitude of effect) is used to determine the overall significance of impact for each element of the onshore project area.
216. The following potential effects upon the qualifying features of the Broadland SPA and Ramsar site utilising ex situ habitats outside of the SPA and Ramsar boundary are anticipated to arise during the construction phase:
- Medium term, temporary habitat loss of up to approximately 1.5ha of arable habitat over approximately 16 weeks in any one area per annum during the two year cable pulling;
 - Medium term, temporary habitat loss of up to approximately 1ha of improved grassland habitat over approximately 16 weeks in any one area per annum during the two year cable pulling; and
 - Medium term, temporary visual, noise and light disturbance of bird species utilising arable habitats.
217. The effects are medium term, and they do not affect either a sensitive habitat or a habitat which is not abundant in the wider area, including the area within 5km of the Broadland SPA and Ramsar site. As such the magnitude of these effects is considered to be low.

River Wensum SSSI

218. Although the exact areas of running track required will not be determined until the detailed design stage post-consent, there is some design flexibility governing the location of jointing pits along the cable route, with a pit required approximately every 800m along the cable route. This allows for environmental sensitivities to be considered and where possible sensitive locations to be avoided. For example, a jointing pit would not be required within the floodplain habitat of the River Wensum (as shown in Figure 23.6). As such no change is anticipated.

Pigney's Wood LNR and Land south of Dillington Carr CWS

219. 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 or Land south of Dillington Carr CWS.
220. Potential disturbance effects upon species (including bird species) present in these designated sites during the 16 week per annum for the two-year cable pulling works is considered in Chapter 22 Onshore Ecology. A potential effect of at most low magnitude was identified in relation to these sites.

Onshore project substation and National Grid substation extension

221. The onshore project substation and National Grid substation extension are located more than 5km from the Broadland SPA and Ramsar site. As such there will be no change upon statutory designated sites due to the proposed onshore project substation or National Grid substation extension.

Impact without mitigation

222. As per Scenario 2, no change upon statutory designated sites is anticipated from the proposed onshore project substation or National Grid substation extension. There is the potential for effects on Broadland SPA and Ramsar site and its ornithological qualifying features as a result of works at the landfall and on the onshore cable route, of low magnitude. There is also the potential for effects on the qualifying features of the Pigney's Wood LNR and Land South of Dillington Carr CWS of at most low magnitude.

223. Without mitigation, the greatest magnitude of effect arising from the project is low, on a low importance receptor (see Table 23.25), resulting in an impact of at worst **minor adverse** significance.

Mitigation

224. The mitigation set out under Scenario 2 would also apply to Scenario 1.

Impact following mitigation

225. The mitigation presented above will help ensure that the disturbance effects are reduced as far as possible. However, as a residual disturbance effect will still remain, the magnitude of effect upon a low importance receptor will remain low, resulting in a residual impact of **minor adverse** significance.

23.7.5.2 Impact 2: Wintering / on passage bird species

23.7.5.2.1 Scenario 2

Landfall

226. Notable bird species (i.e. those listed on Annex 1 of the Birds Directive, UK Red or Amber List species, UKSPI or Norfolk LBAP species) have been recorded within the species study area during the wintering bird surveys in numbers which equate to a negligible to medium importance. As such, there is potential for these species to be affected by the construction of the project.

227. The following potential effects upon notable wintering / on passage bird species may arise during the construction phase at the landfall:

- Medium term, temporary habitat loss of approximately 0.6ha of arable habitats at the landfall HDD entry point for approximately 20 weeks; and

- Medium term, temporary visual, noise and light disturbance of bird species utilising coastal and arable habitats.
228. The effects are medium term, given the duration of the project construction phase, however they do not affect either a sensitive habitat or a habitat which is not abundant in the wider area. As such the magnitude of these effects is low.
229. Table 23.26 summarises those notable bird species which have been recorded as wintering within the species study area in numbers of medium importance.

Table 23.26 Notable ornithological receptors recorded within the species study area over winter (October 2016 – March 2017) including receptor importance and magnitude of effect

Impact	Importance	Distance from landfall	Magnitude of effect	Comments
Common Scoter	Medium	Adjacent	Low	N/A
Ringed plover	Medium	Adjacent	Low	N/A
Herring gull	Medium	Adjacent	Low	N/A
Glaucous gull	Medium	Adjacent	Low	N/A
Kittiwake	Medium	Adjacent	Low	N/A
Black redstart	Medium	Adjacent	No change	Suitable habitats for this species not affected by landfall works.
Starling	Medium	Adjacent	No change	Suitable habitats for this species not affected by landfall works.
House Sparrow	Medium	Adjacent	No change	Suitable habitats for this species not affected by landfall works.
Grey wagtail	Medium	Adjacent	No change	Suitable habitats for this species not affected by landfall works.
Lapwing	Medium	1.8km south-west	No change	N/A

Onshore cable route

230. The following potential effects upon notable wintering / on passage bird species may arise during the construction phase along the onshore cable route:
- Long term, temporary habitat loss of approximately 7ha of arable habitat over approximately two years (duct installation) plus a further 16 weeks in any one area per annum during the two year cable pulling;
 - Long term, temporary habitat loss of approximately 1ha of improved grassland habitat over approximately two years (duct installation) plus a further 16 weeks per annum during the two year cable pulling;
 - Long term, temporary habitat loss of approximately 2.1km of hedgerow habitat across approximately 165 hedgerows over approximately two years (duct installation) - of which approximately 430m across 33 hedgerows will also be lost for further two years during the cable pulling - plus the time take for hedgerows to establish following reinstatement (3-7 years); and

- Long term, temporary visual, noise and light disturbance of bird species utilising arable habitats.
231. The effects are long term, given the duration of the project construction phase, however they do not affect either a sensitive habitat or a habitat which is not abundant in the wider area.
232. Table 23.27 summarises those notable bird species which have been assessed as wintering within the species study area in numbers of medium importance. The potential magnitude of effect upon different species is summarised in Table 23.27.

Table 23.27 Notable ornithological receptors recorded within the species study area over winter (October 2016 – March 2017) including receptor importance and magnitude of effect

Impact	Importance	Distance from cable route	Magnitude of effect	Comments
Common Scoter	Medium	Adjacent	No change	Suitable habitats for these species not affected by cable route works
Ringed plover	Medium	Adjacent	No change	
Herring gull	Medium	Adjacent	No change	
Glaucous gull	Medium	Adjacent	No change	
Kittiwake	Medium	Adjacent	No change	
Black redstart	Medium	Adjacent	Low	Suitable habitat for these species – hedgerow - is localised (maximum 13m in any one location) and small in scale in relation to the available habitat surrounding the onshore project area. An approximately 2.1km loss of hedgerow habitat equates to approximately 0.4km of hedgerow lost per km ² across the onshore project area, which represents approximately 10% of the typical amount of hedgerow per km ² within the county (NBP, 2009). This is an effect of low magnitude.
Starling	Medium	Adjacent	Low	
House Sparrow	Medium	Adjacent	Low	
Grey wagtail	Medium	Adjacent	Low	7ha of habitat which supports this species over winter is located within the wintering bird survey area. This loss of habitat represents approximately 5% of this habitat available in the areas surrounding the cable route, so this is an effect of low magnitude.
Lapwing	Medium	1.8km south-west	Low	

233. In addition to the effects outlined above, it has also been noted that the River Wensum floodplain on the southern (right hand) bank of the river within the species study area is currently under a Countryside Stewardship scheme to target wintering waders and wildfowl. Natural England has confirmed that for this area it should be presumed that such species will be present between November and February inclusive. It is therefore assumed that this is a sensitive habitat for wintering waders and wildfowl. This habitat will be subject to disturbance for up to eight weeks during

the trenchless crossing activities at these locations, plus an additional 16 weeks per annum during the two-year cable pulling works. If these periods occur during winter, there is a potential effect of low magnitude to a medium sensitivity receptor (species present not known).

Onshore project substation, National Grid substation extension and overhead line modifications

234. No notable species have been recorded wintering / on passage within 300m of the onshore project substation, National Grid substation extension and overhead line modifications. As such there will be no change upon notable wintering / on passage bird species due to the proposed project onshore project substation, National Grid Extension and overhead line modification works.

Impact without mitigation

235. No change upon notable wintering / passage bird species are anticipated as a result of the onshore project substation, National Grid substation extension and overhead line modification works. Potential effects are anticipated as a result of works at the landfall and on the onshore cable route, of low magnitude (see Table 23.26 and Table 23.27 respectively).

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

Mitigation

237. The following mitigation is proposed in relation to wintering / on passage birds:

- To minimise the potential effects upon lapwing and other species using arable land within the onshore project area, it is proposed that these habitats are only subject to works for one winter period in any one area in consecutive years (for example, if works occur during the winter period 2021-2022 (November to February), no winter works are to be undertaken in the same location in winter 2022-2023);
- All habitats which are temporarily lost during construction will be reinstated following completion of construction. All hedgerows which are removed to enable the project will be reinstated following guidance within the Norfolk hedgerow BAP and will include appropriate species for north-east Norfolk (NBP, 2009). Future hedgerow management to include allowing standard trees to develop; and
- The project is aiming for a construction scenario whereby construction 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). If this is not possible, an area of the floodplain habitat will be left undisturbed to provide wintering habitat for waders / wildfowl using this site for the duration of the works in this area.

238. These mitigation measures are captured within the OLEMS (Document reference 8.7).

Impact following mitigation

239. The mitigation presented above will help to ensure that the disturbance effects are reduced as far as possible. However, as a residual disturbance effect will still remain, the magnitude of effect will remain low, resulting in a residual impact of **minor adverse** significance.

23.7.5.2.2 *Scenario 1*

Landfall

240. Under Scenario 1, the worst case assumption for the proposed landfall works will be the same as under Scenario 2. As such, the impacts predicted will be the same (i.e. at most of low magnitude).

Onshore cable route

241. Under Scenario 1, the following potential effects upon notable wintering / on passage bird species may arise during the construction phase along the onshore cable route:
- Medium term, temporary habitat loss of up to approximately 1.5ha of arable habitat over approximately 16 weeks in any one area per annum during the two year cable pull;
 - Medium term, temporary habitat loss of up to approximately 1ha of improved grassland habitat over approximately 16 weeks in any one area per annum during the two year cable pull;
 - Long term, temporary habitat loss of approximately 430m of hedgerow habitat across 33 hedgerows over approximately 16 weeks in any one area, plus the time take for hedgerows to establish following reinstatement (3-7 years); and
 - Medium term, temporary visual, noise and light disturbance of bird species utilising arable habitats.
242. The effects are medium term (with the exception of hedgerow loss), and do not affect either a sensitive habitat or a habitat which is not abundant in the wider area.

243. Table 23.28 summarises those notable bird species which have been assessed as wintering within the species study area in numbers of medium importance as well as the potential magnitude of effect upon different species.

Table 23.28 Notable ornithological receptors recorded within the species study area over winter (October 2016 – March 2017) including receptor importance and magnitude of effect

Species	Importance	Distance from cable route	Magnitude of effect	Comments
Common Scoter	Medium	Adjacent	No change	Suitable habitats for these species not affected by cable route works
Ringed plover	Medium	Adjacent	No change	
Herring gull	Medium	Adjacent	No change	
Glaucous gull	Medium	Adjacent	No change	
Kittiwake	Medium	Adjacent	No change	
Black redstart	Medium	Adjacent	Negligible	Suitable habitat for these species – hedgerow - is localised (maximum 6m in any one location) and small in scale in relation to the available habitat surrounding the onshore project area. An approximately 430m loss of hedgerow habitat equates to approximately 0.08km ² of hedgerow lost per km ² across the onshore project area, which represents approximately 1% of the typical amount of hedgerow per km ² within the county (NBP, 2009). This is an effect of negligible magnitude.
Starling	Medium	Adjacent	Negligible	
House Sparrow	Medium	Adjacent	Negligible	
Grey wagtail	Medium	Adjacent	Negligible	
Lapwing	Medium	1.8km south-west	Low	1.5ha of habitat which supports this species over winter is located within the wintering bird survey area. This loss of habitat represents approximately 1% of this habitat available in the areas surrounding the cable route, so this is an effect of low magnitude.

Onshore project substation and National Grid substation extension

244. No notable species have been recorded wintering / on passage within 300m of the onshore project substation or National Grid substation extension. As such there will be no change upon notable wintering / on passage bird species due to the proposed onshore project substation development and National Grid substation extension.

Impact without mitigation

245. As per Scenario 2, no change upon notable wintering / on passage bird species are anticipated as a result of the onshore project substation or National Grid substation extension. Potential effects are anticipated as a result of works at the landfall and on the onshore cable route, of negligible to low magnitude (see Table 23.26 and Table 23.28 respectively).

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

Mitigation

247. The mitigation set out under Scenario 2 (section 23.7.5.2.1) would also apply to Scenario 1.

Impact following mitigation

248. The mitigation will help ensure that the disturbance effects are reduced as far as possible. However, as a residual disturbance effect will still remain, the magnitude of effect will remain low, resulting in a residual impact of **minor adverse** significance.

23.7.5.3 Impact 3: Breeding bird species

23.7.5.3.1 Scenario 2

Landfall

249. Sand martin are known to nest in the Happisburgh cliffs, approximately 130m from the landfall.
250. The project has committed to long HDD under the cliffs at Happisburgh. As a consequence, this nesting site will not be directly affected by the proposed works.
251. The potential for the proposed works to give rise to vibration and light emissions in the vicinity of these nests has been considered. The nearest above ground construction location from the sand martin nests is approximately 130m at its closest point, landward of the nesting site. This is within the maximum distance which vibration effects are perceptible from any construction activity (277m), but below the maximum distance where vibration effects would be likely to give rise to physical effects (65m). The HDD will be located at up to 20m relative mean sea level at the Happisburgh cliffs. The landfall area is underlain by sandy clay and sand to a depth of approximately 18m below ground level (Chapter 19 Ground Conditions and Contamination, section 19.6.1.1). Loose material is a poor propagator of vibration effects, with compact substrate and material at risk of propagating vibration effects over longer distances. HDD through this loose material would therefore be anticipated to generate limited vibration effects. Vibration arising from HDD activities is anticipated therefore to have a minimal effect on nesting sand martin.
252. The landfall compound will need to be illuminated during construction. Effects of light disturbance on nesting birds are considered below.
253. The following potential effects upon breeding bird species will arise during the construction phase at the landfall:

- Medium term, temporary habitat loss of approximately 0.6ha of arable habitats at the landfall HDD entry point for approximately 20 weeks;
- Risk of damaging or destroying ground nesting birds (i.e. skylarks) during construction); and
- Disturbance of nesting sand martin due to 24hr lighting at the landfall compound.

254. The loss of arable breeding habitat will occur at most across a single season over a habitat which is abundant in the wider area, and therefore is classified as an effect of low magnitude.

255. Potential disturbance effects upon nesting sand martins and common bird species are of low magnitude.

Onshore cable route

256. The following potential effects upon breeding bird species will arise during the construction phase along the onshore cable route:

- Long term, temporary habitat loss of approximately 333ha of arable habitats along the onshore cable route for approximately two years (duct installation) plus up to approximately 7ha of this for a further 16 weeks in any one area per annum during the two year cable pull element of the construction phase;
- Long term, temporary habitat loss of approximately 0.15ha of semi-natural broadleaved woodland habitat along the cable route for approximately two years (duct installation), plus a further 16 weeks per annum during the two year cable pull element of the construction phase;
- Long term, temporary habitat loss of approximately 2.1km of hedgerow habitat along the cable route for approximately two years (duct installation), of which approximately 430m will also be lost for an additional two years (cable pull) during the construction phase;
- Long term, temporary habitat loss of approximately 1ha of coastal floodplain grazing marsh habitat along the onshore cable route for approximately two years (duct installation) plus a further 16 weeks per annum during the two year cable pull element of the construction phase;
- Long term, temporary habitat loss of approximately 1ha of lowland fen habitat along the onshore cable route for approximately two years (duct installation) plus a further 16 weeks per annum during the two year cable pull element of the construction phase; and
- Risk of damaging or destroying the nests of ground nesting birds (i.e. skylarks) during construction.

257. The loss of arable breeding habitat is of sufficient duration to be classified as an effect of medium magnitude.

Onshore project substation

258. The following potential effects upon breeding bird species will arise during the construction phase at the onshore project substation:

- Permanent loss of approximately 240m species-rich hedgerow with trees;
- Long term, temporary habitat loss of approximately 9.5ha of arable habitats for 30 months (construction phase) (plus a further 1ha at access works at Spicer's corner); and
- Risk of damaging or destroying the nest of ground nesting birds (i.e. skylarks) during construction).

259. The permanent and temporary loss of hedgerow is of low magnitude given the context of the surrounding available hedgerow habitat. The loss of arable breeding habitat is of sufficient duration to be classified as an effect of medium magnitude.

National Grid substation extension and overhead line works

260. The following potential effects upon breeding birds will arise during the construction phase at the National Grid substation extension and overhead line modifications:

- Long term, temporary habitat loss of approximately 27.4ha of arable habitats for 30 months;
- Long term, temporary habitat loss of approximately 210m of species-poor hedgerow (100m of which is with trees) habitat for 30 months and
- Risk of damaging or destroying the nests of ground nesting birds (i.e. skylarks) during construction.

261. The loss of arable breeding habitat is of sufficient duration to be classified as an effect of medium magnitude.

Impact without mitigation

262. The potential disturbance effects upon nesting birds and loss of breeding habitat at the landfall are anticipated to be of low magnitude. The loss of hedgerows is also anticipated to be low magnitude. The loss of arable breeding habitat is anticipated to be an effect of medium magnitude at the onshore project substation, National Grid substation and overhead line works and on the onshore cable route.

263. As a BoCC4 red list species present throughout the arable habitats of the onshore project area, skylarks are a receptor of medium importance. Common bird species are a receptor of low importance.

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

Mitigation

265. The following mitigation is proposed in relation to breeding bird species:

- Construction methodologies proposed for site vegetation clearance include the removal of all nesting habitat for common breeding birds outside of the bird breeding season (which is typically between March and August inclusive, but is weather and temperature dependant). As such, risk of damaging, destroying or disturbing the nest of any wild bird (either during construction or whilst in use) during the onshore project area works has been removed;
- Keep the winter crop stubble within the onshore project area low during the bird breeding season (which is typically from March to August, although can commence earlier or later depending on the weather conditions) in order to minimise the chance of notable ground nesting birds (i.e. skylarks, corn bunting and stone curlew) nesting prior to work on arable land. If winter crop stubble is not kept low and should works commence within the bird breeding season (March - August inclusive), a pre-construction check for nesting skylarks will be undertaken at most 48 hours in advance of construction, and any nests identified will be protected by the implementation of a suitable exclusion zone and left undisturbed until the young have fledged;
- Set aside ground-nesting bird areas outside of 50m of the cable route prior to construction works. The locations for these set-aside mitigation areas would be agreed in consultation with Natural England post-consent, and would follow the RPSB's Skylark: Advice for Farmers in creating skylark habitat (available at <https://www.rspb.org.uk/our-work/conservation/conservation-and-sustainability/farming/advice/helping-species/skylark/>);
- All hedgerows which are removed to enable the project will be reinstated following guidance within the Norfolk hedgerow BAP and will include appropriate species for north-east Norfolk (NBP, 2009). Future hedgerow management should include allowing standard trees to develop. Hedgerow removal will be undertaken outside of the bird nesting season where possible (which is typically between March and August inclusive, but is weather and temperature dependant). Hedgerows will be reinstated during early winter when they have the greatest chance of taking root, meaning that in practice there will be a gap of one season (one year) between each hedgerow removal and its reinstatement;
- 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 250m 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. Chapter 29 Landscape and Visual Impact Assessment gives full details of the proposed landscape mitigation planting; and

- Recommendations regarding birds in the Bat Conservation Trust's (BCT) *Artificial lighting and wildlife guidance* (2014) will be adhered to when designing lighting during temporary works at the HDD compound.

266. Landscaping and ecological management proposals are captured within the OLEMS (Document reference 8.7).

Impact following mitigation

267. The implementation of mitigation would reduce the risk to breeding birds therefore the magnitude of effect upon breeding skylark (a receptor of medium importance) reduces to low, resulting in a residual impact of **minor adverse** significance.

23.7.5.3.2 Scenario 1

Landfall

268. Under Scenario 1, the worst case assumption for the proposed landfall works will be the same as under Scenario 2. As such, the impacts predicted will be the same (i.e. of at most low magnitude).

Onshore cable route

269. Under Scenario 1, all suitable hedgerow habitat along the cable route would have been already removed during the construction of Norfolk Vanguard. All site preparation activities within arable land habitat will be undertaken outside of the bird breeding season (which is typically between March and August inclusive, but is weather and temperature dependant). As such risk of damaging, destroying or disturbing the nest of any wild bird (either during construction or whilst in use) during the onshore cable pulling works has been removed.

270. The following potential effects upon breeding bird species will arise during the cable pulling phase along the onshore cable route:

- Medium term, temporary habitat loss of approximately 7ha of arable nesting habitat for approximately 16 weeks per annum during the two year cable pull element of the construction phase;
- Medium term, temporary habitat loss of up to approximately 1ha of coastal floodplain grazing marsh habitat along the onshore cable route for approximately 16 weeks per annum during the two year cable pull element of the construction phase;
- Medium term, temporary habitat loss of up to approximately 1ha of lowland fen habitat along the onshore cable route for approximately 16 weeks per annum during the two year cable pull element of the construction phase; and

- Risk of damaging or destroying the nests of ground nesting birds (i.e. skylarks) during construction.

271. The loss of arable breeding habitat is of sufficient duration to be classified as an effect of low magnitude.

Onshore project substation

272. The following potential effects upon breeding bird species will arise during the construction phase at the onshore project substation:

- Permanent loss of approximately 390m of hedgerow (of which 360m is species-poor hedgerow with trees, and 30m species-rich hedgerow with trees);
- Long term, temporary habitat loss of approximately 9.5ha of arable habitats for 30 months (construction phase) (plus a further 1ha at access works at Spicer's corner);
- Long term, temporary habitat loss of approximately 400m of hedgerow (of which 270m is species-rich hedgerow, and 130m species-rich hedgerow with trees) habitat for 30 months (construction phase); and
- Risk of damaging or destroying the nest of ground nesting birds (i.e. skylarks) during construction).

273. The permanent and temporary loss of hedgerow is of low magnitude given the context of the surrounding available hedgerow habitat. The loss of arable breeding habitat is of sufficient duration to be classified as an effect of medium magnitude.

National Grid substation extension

274. The following potential effects upon breeding bird will arise during the construction phase at the National Grid substation extension:

- Long term, temporary habitat loss of approximately 9.5ha of arable habitats for 30 months (construction phase);
- Permanent habitat loss of approximately 140m of species-poor defunct hedgerow habitat at the National Grid substation extension; and
- Risk of damaging or destroying the nests of ground nesting birds (i.e. skylarks) during construction).

275. The loss of arable breeding habitat is of sufficient duration to be classified as an effect of medium magnitude.

Impact without mitigation

276. The potential disturbance effects upon nesting birds and loss of breeding habitat at the landfall are anticipated to be of low magnitude. The loss of hedgerows is also anticipated to be low magnitude. The loss of arable breeding habitat is anticipated to be an effect of medium magnitude at the onshore project substation and National Grid substation extension and low on the onshore cable route.

277. As a BoCC4 red list species present throughout the arable habitats of the onshore project area, skylarks are a receptor of medium importance. Common bird species are a receptor of low importance.
278. Without mitigation, the greatest magnitude arising from the project is medium magnitude on a medium importance receptor, resulting in an impact of at worst **moderate adverse** significance.

Mitigation

279. The mitigation measures set out under Scenario 2 would be adhered to during Scenario 1 works.

Impact following mitigation

280. Following mitigation, the magnitude of effect upon breeding skylark (a receptor of medium importance) reduces to low, resulting in a residual impact of **minor adverse** significance.

23.7.6 Potential Impacts during Operation

281. Impacts during the operational phase of the project will be very similar regardless of the scenario and therefore are assessed together in this section.
282. Potential operational impacts are limited to maintenance activities at the onshore project substation and National Grid substation extension, as no regular works are required along the onshore cable route. As a result, the impacts during operation are substantially less than those identified during construction.

23.7.6.1 Impact 1: Disturbance to habitats and bird species from maintenance activities

23.7.6.1.1 Onshore project substation and National Grid substation extension

283. Routine maintenance of the onshore project substation and the National Grid substation extension will require an average of one visit per week, involving a single vehicle and staff during daylight 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 only affect receptors in the immediate vicinity of the onshore project substation and National Grid substation extension.

23.7.6.1.2 Impact without mitigation

284. Without mitigation, the greatest magnitude arising from the project is negligible on at worst medium importance receptors, resulting in an impact of at worst **minor adverse** significance.

23.7.6.1.3 Mitigation

285. None is required as the magnitude of effect is already negligible.

23.7.6.2 Impact 2: Disturbance to onshore ornithology from operational lighting and noise

23.7.6.2.1 Onshore project substation and National Grid substation extension

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

23.7.6.2.2 Impact without mitigation

287. Without mitigation, the greatest magnitude arising from the project will be negligible on at worst medium importance receptors, resulting in an impact of at worst **minor adverse** significance.

23.7.6.2.3 Mitigation

288. A lighting scheme will be designed for the final design for the permanent infrastructure, which will include measures to minimise light spill following the recommendations regarding birds set out in the BCT's *Artificial lighting and wildlife guidance* (2014).

23.7.6.2.4 Impact following mitigation

289. 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 following mitigation.

23.7.7 Potential Impacts during Decommissioning

290. 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.

291. 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.

292. 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.

293. Whilst details regarding the decommissioning of the onshore project substation are currently unknown, considering the worst case assumption which would be the removal and reinstatement of the current land use at the site, it is anticipated that the impacts would be similar or less than to those experienced during construction.

294. 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.

23.8 Cumulative Impacts

295. The assessment of cumulative impact has been undertaken as a two stage process. Firstly, all the impacts from previous sections have been assessed for potential to act cumulatively with other projects. This summary assessment is set out in Table 23.29.

Table 23.29 Potential cumulative impacts

Impact		Potential for cumulative impact	Rationale
Construction			
1	Impacts to designated sites	Yes	Impacts to interest features of designated sites may be exacerbated by other projects
2	Impacts to wintering / on passage bird species	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
3	Impacts to breeding bird species	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county
Operation			
1	Disturbance to habitats and bird species from	Yes	Impact to species due to other projects may increase the cumulative impacts to species within the county

Impact		Potential for cumulative impact	Rationale
	maintenance activities		
2	Disturbance to onshore ornithology from 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 the same as those identified during the construction stage.			

296. 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 23.7 have also been identified. Where there is an overlap, an assessment of the cumulative magnitude of effect is provided.
297. Projects identified for potential cumulative impacts that were agreed as part of the Norfolk Boreas consultation as part of the PEIR (Norfolk Boreas Limited, 2018). 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 23.30.

Table 23.30 Summary of projects considered for the CIA in relation to onshore ornithology

Project	Status	Development period	¹⁴ 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	Overlapping proposed project boundaries at Necton may result in impacts of a direct and / or indirect nature during operation
A47 corridor improvement programme –	Pre-application	Start works April 2021	26.7	https://highwaysengland.co.uk/projects/a47-north-	Medium	No	Development is located 2.5km from the project boundary and is therefore within the internationally designated

¹⁴ Shortest distance between the considered project and Norfolk Vanguard – unless specified otherwise.

Project	Status	Development period	¹⁴ Distance from onshore project area (km)	Project definition	Project data status	Included in CIA	Rationale
North Tuddenham to Easton	(application due 2020)	Open May 2023		tuddenham-to-easton-improvement-scheme/			site study area, but is more than 5km from the internationally designated sites considered in this chapter. No cumulative impacts are anticipated.
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 outwith the study area for onshore ornithology. 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 outwith the study area for onshore ornithology. 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 within the internationally designated site study area, but is more than 5km from the internationally designated sites considered in this chapter. No cumulative impacts are anticipated.
Third River Crossing (Great Yarmouth)	Pre-application (application due 2019)	Expected construction start in late	28	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-	Medium	No	Development is located 18km from the project boundary and is therefore outwith the study area(s) identified for

Project	Status	Development period	¹⁴ Distance from onshore project area (km)	Project definition	Project data status	Included in CIA	Rationale
		2020 Open early 2023		improvement-plans/great-yarmouth/third-river-crossing			onshore ornithology. No cumulative impacts are anticipated.
King's Lynn B Power Station amendments	Approved	Expected construction start 2019 to 2022	28	https://www.kingslynnbccgt.co.uk/	High	No	Development is located 18km from the project boundary and is therefore outwith the study area(s) identified for onshore ornithology. 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 internationally designated site and designated sites study areas, 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	Approved	Construction start date Spring 2019	1.0	Public information leaflets available: https://www.north-norfolk.gov.uk/media/3371/bacton-to-walcott-public-information-	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.

Project	Status	Development period	¹⁴ Distance from onshore project area (km)	Project definition	Project data status	Included in CIA	Rationale
				booklet-july-2017.pdf			
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=summary&keyVal=_NNORF_DCAPR_93543	Medium	Yes	Coastal protection scheme is located 0.1km from the project boundary. This has the potential act cumulatively upon bird species which utilise coastal environments at the landfill.
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 1.3km from the project boundary and is therefore within the internationally designated site and designated sites study areas, but, 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	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 1.4km from the project boundary and is therefore within the internationally designated site and designated sites study areas, but is more than 5km from the internationally designated sites and 2km from the nationally designated

Project	Status	Development period	¹⁴ Distance from onshore project area (km)	Project definition	Project data status	Included in CIA	Rationale
appropriate associated infrastructure with vehicle access via Hall Road 3PL/2018/0993 /F							sites considered in this chapter. No cumulative impacts are anticipated.

298. Under Scenario 2 Norfolk Vanguard does not proceed to construction and therefore under this scenario Norfolk Vanguard is not considered as part of the CIA.
299. Under Scenario 1 the duct installation 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 (cables being pulled into pre-installed ducts) and onshore project substation (including the National Grid substation extension, any landscaping or planting, and the onshore 400kV cable route).
300. In summary, the following projects will be assessed for potential direct cumulative impacts:

Scenario 1

- Norfolk Vanguard Offshore Wind Farm;
- Dudgeon Offshore Wind Farm;
- Hornsea Project Three Offshore Wind Farm; and
- Happisburgh coastal defence/protection works.

Scenario 2

- Dudgeon Offshore Wind Farm;
- Hornsea Project Three Offshore Wind Farm; and
- Happisburgh coastal defence/protection works.

301. 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.

23.8.1 Cumulative Impacts during Construction

23.8.1.1 Cumulative Impact 1: Designated sites

23.8.1.1.1 Scenario 1

302. Ex situ habitats of the Broadland SPA and Ramsar site are located both within the footprint of the Norfolk Boreas cable pulling works and the footprint of the Norfolk Vanguard duct installation works. The combined duration and scale of the effects from Norfolk Boreas and Norfolk Vanguard are of the same scale as for Norfolk Boreas constructed alone i.e. under Scenario 2 (**minor adverse**).
303. No ex situ habitats within 5km of the Broadland SPA and Ramsar site – nor the River Wensum SSSI – are located within a precautionary 1km buffer of both Hornsea Project Three and the Norfolk Boreas. As such no cumulative effect is experienced,

and therefore effects are of the same significance set out in section 23.7.5.1 (**minor adverse**).

23.8.1.1.2 Scenario 2

304. As for Scenario 1, no ex situ habitats within 5km of the Broadland SPA and Ramsar site – nor the River Wensum SSSI – are located within a precautionary 1km buffer of both Hornsea Project Three and the Norfolk Boreas.
305. There is the potential for air quality emissions arising from an 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. 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).
306. 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 23.1 below.

Table 23.31 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%

307. 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.

308. 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.
309. 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 23.7.5.1.

23.8.1.2 Cumulative Impact 2: Wintering / on passage bird species

23.8.1.2.1 Scenario 1

310. Suitable habitat for wintering/on passage bird species are located both within the footprint of the Norfolk Boreas cable pulling works and the footprint of the Norfolk Vanguard duct installation works. The combined duration and scale of the effects from Norfolk Boreas and Norfolk Vanguard are of the same scale as for Norfolk Boreas constructed alone i.e. under Scenario 2 (**minor adverse**).
311. No notable species have been recorded wintering / on passage within a precautionary 1km buffer of both Hornsea Project Three project and Norfolk Boreas. As such no cumulative effect is experienced, and therefore are of the same significance set out in section 23.7.5.2 (**minor adverse**).

23.8.1.2.2 Scenario 2

312. As for Scenario 1, no notable species have been recorded wintering / on passage within a precautionary 1km buffer of both 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 23.7.5.2 (**minor adverse**).

23.8.1.3 Cumulative Impact 3: Breeding bird species

23.8.1.3.1 Scenario 1

313. The proposed onshore project substation, National Grid substation extension works and the duct installation works for Norfolk Vanguard have the potential to give rise to cumulative effects. As detailed in Chapter 23 Onshore Ornithology of the Norfolk Vanguard ES (Norfolk Vanguard Limited, 2018), these works are expected to potentially give rise to effects including a large scale long term loss of arable breeding habitat and localised loss of hedgerow breeding habitat, giving rise to effects of medium magnitude. When combined with the proposed works associated

with Norfolk Boreas, the duration and scale of the effects give rise to effects of medium magnitude. As the receptor is of medium importance, this give a cumulative impact is of moderate adverse significance. Mitigation measures are set out in the Norfolk Vanguard ES (which are the same as those detailed in section 23.7.5.3.1) to reduce this impact. Following implementation of the mitigation measures, the magnitude of effect is reduced to low, giving a cumulative impact of **minor adverse** significance.

314. Hornsea Project Three will give rise to at most localised loss of arable or hedgerow breeding habitat. As such the cumulative effects are of the same significance set out in section 23.7.5.3 (**minor adverse**).
315. The Happisburgh coastal protection scheme is located within the same potential area of sand martin nesting habitat as Norfolk Boreas. As Norfolk Boreas will result in short term effects of low magnitude only and will not result in the loss of any suitable sand martin nesting habitat, cumulative impacts with this scheme are not anticipated. As such the effects are of the same significance set out in section 23.7.5.3 (**minor adverse**).

23.8.1.3.2 Scenario 2

316. Hornsea Project Three will give rise to at most localised loss of arable or hedgerow breeding habitat. As such the cumulative effects are of the same significance set out in section 23.7.5.3 (**minor adverse**).
317. The Happisburgh coastal protection scheme is located within the same potential area of sand martin nesting habitat as Norfolk Boreas. As Norfolk Boreas will result in short term effects of low magnitude only and will not result in the loss of any suitable sand martin nesting habitat, cumulative impacts with this scheme are not anticipated. As such the effects are of the same significance set out in section 23.7.5.3 (**minor adverse**).

23.8.2 Cumulative Impacts during Operation

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

318. The Norfolk Vanguard and Dudgeon Offshore Wind Farm substations are anticipated to have similar maintenance requirements as Norfolk Boreas (i.e. an average of one visit per week, involving a single vehicle and staff during daylight 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 substation, with at worst medium importance. As such, cumulative effects are of **minor adverse** significance, the same significance set out in section 23.7.6.1.

23.8.2.2 Cumulative Impact 2: Disturbance to onshore ornithology from operational lighting and noise

319. Operation lighting from the Dudgeon Offshore Wind Farm substation is subject to mitigation measures 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 operation 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, with at worst medium importance. As such, and therefore cumulative effects are of **minor adverse** significance, the same significance set out in section 23.7.6.2.

23.8.3 Cumulative Impacts during Decommissioning

320. 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 the same as those identified during the construction stage.

23.9 Inter-relationships

321. Table 23.32 lists out the inter-relationships between this chapter and other chapters within the ES.

Table 23.32 Chapter topic inter-relationships

Topic and description	Related Chapter	Where addressed in this Chapter	Rationale
Habitats which support onshore ornithology	Chapter 22 Onshore Ecology	Section 23.7.5 (all impacts)	Impacts to habitats supporting onshore ornithology may affect the bird species in the area.
Noise and vibration disturbance on bird species	Chapter 25 Noise and Vibration	Section 23.7.5 (all impacts)	Any noise and vibration generated by the project may give rise to disturbance impacts upon protected bird species

Topic and description	Related Chapter	Where addressed in this Chapter	Rationale
Air quality impacts on bird species and their habitats	Chapter 26 Air Quality	Section 23.7.5 (all impacts)	Nutrient nitrogen deposition on habitats which support bird species
Lighting impacts to bird species	Chapter 29 Landscape and Visual Impact Assessment	Section 23.7.5 (all impacts)	Construction and maintenance lighting (covered in Chapter 29 Landscape and Visual Impact Assessment) may cause disturbance to protected bird species

23.10 Interactions

322. 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 23.33, along with an indication as to whether the interaction may give rise to synergistic impacts.

Table 23.33 Interaction between impacts

Potential interaction between impacts			
Construction			
	1 Statutory designated sites	2 Wintering / on passage bird species	3 Breeding bird species
1 Statutory designated sites	-	Yes	Yes
2 Wintering / on passage bird species	Yes	-	Yes
3 Breeding bird species	Yes	Yes	-
Operation			
	1 Habitat and species during maintenance	2 Bird species during operational lighting and noise	
1 Habitat and species during maintenance	-	No	
2 Bird species during operational lighting and noise	No	-	
Decommissioning			

Potential interaction between impacts

Construction

1 Statutory designated sites

2 Wintering / on passage bird species

3 Breeding bird species

It is anticipated that the decommissioning impacts will be similar in nature to those of construction.

23.11 Summary

323. Provided below in, Table 23.34 and Table 23.35, are summaries of the impacts identified under Scenario 1 and under Scenario 2 respectively.
324. With the application of mitigation measures the project under both scenarios is predicted to have no greater than **minor adverse** impacts in relation to onshore ornithology. Mitigation measures include removing vegetation prior to bird breeding seasons, reinstatement of removed hedgerows following construction, and an operational lighting scheme at the onshore project substation that conforms to guidance set out in the BCT's *Artificial Lighting And Wildlife Guidance* (2014).

Table 23.34 Potential impacts identified for onshore ornithology Under Scenario 1

Potential Impact	Receptor	Importance	Magnitude	Significance	Mitigation	Residual Impact
Construction						
1	Designated sites	Low	Low	Minor adverse	Yes – OLEMS	Minor adverse
2	Wintering / on passage bird species	Medium	Low	Minor adverse	Yes - OLEMS	Minor adverse
3	Breeding bird species	Medium	Medium	Moderate adverse	Yes - OLEMS	Minor adverse
Operation						
1	Disturbance to habitat and species from maintenance activities	Medium	Negligible	Minor adverse	None required.	Minor adverse
2	Disturbance to onshore ornithology from operational lighting and noise	Medium	Negligible	Minor adverse	Yes - OLEMS	Minor adverse
Decommissioning						
Impacts similar or less 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 the same as those identified during the construction stage.						

Table 23.35 Potential impacts identified for onshore ornithology Under Scenario 2

Potential Impact	Receptor	Importance	Magnitude	Significance	Mitigation	Residual Impact
Construction						
1	Designated sites	Low	Medium	Minor adverse	Yes - OLEMS	Minor adverse
2	Wintering / on passage bird species	Medium	Low	Minor adverse	Yes – OLEMS	Minor adverse
3	Breeding bird species	Medium	Medium	Moderate adverse	Yes – OLEMS	Minor adverse
Operation						
1	Disturbance to habitat and species from maintenance activities	Medium	Negligible	Minor adverse	None required.	Minor adverse
2	Disturbance to onshore ornithology from operational lighting and noise	Medium	Negligible	Minor adverse	Yes – OLEMS	Minor adverse
Decommissioning						
Impacts similar or less 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 the same as those identified during the construction stage.						

23.12 References

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