Norfolk Boreas Offshore Wind Farm

Chapter 21

Land Use and Agriculture

Environmental Statement

Volume 1

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Glossary of Acronyms

ALC	Agricultural Land Classification
ALO	Agricultural Liaison Officer
BMV	Best and most versatile
CEMP	Construction Environment Management Plan
CIA	Cumulative Impact Assessment
CoCP	Code of Construction Practice
CRoW	Countryside and Rights of Way Act 2000
DCO	Development Consent Order
DECC	Department of Energy and Climate Change
Defra	Department for Environment, Food and Rural Affairs
DMRB	Design Manual for Roads and Bridges
EA	Environment Agency
EIA	Environmental Impact Assessment
ELS	Entry Level Stewardship
EPP	Evidence Plan Process
ES	Environmental Statement
ESS	Environmental Stewardship Scheme
GVA	Gross Value Added
ha	Hectares
HDD	Horizontal Directional Drilling
HLS	Higher Level Stewardship
HVAC	High Voltage Alternating Current
HVDC	High Voltage Direct Current
JCS	Joint Core Strategy
kV	Kilovolts
LPA	Local Planning Authority
MAFF	Ministry of Agriculture, Fisheries and Food
NFU	National Farmers Union
NPPF	National Planning Policy Framework
NPS	National Policy Statements
NSIP	Nationally Significant Infrastructure Project
NSRI	National Soil Resources Institute
OCoCP	Outline Code of Construction Practice
OELS	Organic Entry Level Stewardship
PEIR	Preliminary Environmental Information Report
PPD	Preferred Policy Direction
PRoW	Public Right of Way
SMP	Soil Management Plan
VWPL	Vattenfall Wind Power Limited

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.
Link boxes	Underground chambers or above ground cabinets next to the cable trench housing low voltage electrical earthing links.
Mobilisation area	Areas approx. 100 x 100m used as access points to the running track for duct installation. Required to store equipment and provide welfare facilities. Located adjacent to the onshore cable route, accessible from local highways network suitable for the delivery of heavy and oversized materials and equipment.
National Grid new / replacement overhead line tower	New overhead line towers to be installed at the National Grid substation.
National Grid overhead line temporary works	Area within which the work will 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.
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 an overhead line modifications).
Onshore project substation	A compound containing electrical equipment to enable connection to the National Grid. The substation will convert the exported power from HVDC to HVAC, to 400kV (grid voltage). This also contains equipment to help maintain stable grid voltage.
Running track	The track along the onshore cable route which the construction traffic would use to access workfronts.
The Applicant	Norfolk Boreas Limited

The project	Norfolk Boreas Wind Farm including the onshore and offshore infrastructure.
Transition pit	Underground structures that house the joints between the offshore export cables and the onshore cables.
Trenchless crossing 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.

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21 LAND USE & AGRICULTURE

21.1 Introduction

1. This chapter of the Environmental Statement (ES) considers the potential impacts of the proposed Norfolk Boreas Offshore Wind Farm (hereafter 'the project') on land use and agriculture. The chapter provides an overview of the existing land use where the onshore project area is proposed, followed by an assessment of the potential impacts and associated mitigation for the construction, operation and decommissioning of the project.

2. The focus of this chapter is on land use and agriculture (potential impacts on human beings including landowners, occupiers, local communities and other land users as well as bio-physical elements of soils, the surrounding environment and the productivity of the land). Potential impacts on geology, ground conditions and contamination are considered in Chapter 19 Ground Conditions and Contamination.

3. Vattenfall Wind Power Limited (VWPL) (the parent company of Norfolk Boreas Limited) is also developing Norfolk Vanguard, a 'sister project' to Norfolk Boreas.

4. In order 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.

5. The Environmental Impact Assessment (EIA) has been 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.

6. The assessment also considers cumulative impacts of existing and proposed projects. The methodology adhered to for the EIA and Cumulative Impact Assessment (CIA) is discussed in section 21.4.

7. Figures which accompany the text in this chapter are provided in Volume 2 Figures.

8. Due to the close association between land use, agriculture, ground conditions, groundwater, surface water and ecology topics, this chapter should also be read in

conjunction with the other related ES chapters (and their appendices and supporting documents). The relevant chapters are:

- Chapter 19 Ground Conditions and Contamination;
- Chapter 22 Onshore Ecology;
- Chapter 24 Traffic and Transport;
- Chapter 27 Human Health;
- Chapter 28 Onshore Archaeology and Cultural Heritage;
- Chapter 29 Landscape and Visual Impact Assessment;
- Chapter 30 Tourism and Recreation; and
- Chapter 31 Socio-economics.

21.2 Legislation, Guidance and Policy

9. There are a number of pieces of legislation, policy and guidance applicable to land use and agriculture. The following sections provide detail on key pieces of international and UK legislation, policy and guidance which are relevant to this chapter.

21.2.1 Legislation and Policy

10. The following UK legislation is considered the most relevant to land use and agriculture considered in this chapter.

- Marine and Coastal Access Act 2009;
- The Commons Act 2006;
- The Environmental Stewardship (England) Regulations 2005 (as amended);
- Countryside and Rights of Way Act (CRoW) 2000;
- National Planning Policy Framework (NPPF) 2018; and
- Natural Environment White Paper 2011.

11. Further detail on policy and legislation in relation to the wider project is provided in Chapter 3 Policy and Legislative Context.

12. The assessment of potential impacts upon land use and agriculture 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).

13. The specific requirements of the NPS in relation to land use and agriculture are summarised in Table 21.1, and includes where in the ES they are addressed.

Table 21.1 NPS assessment requirements relevant to land use and agriculture

NPS Requirement	NPS reference	ES reference
EN-1 Overarching NPS for Energy		
The ES [Environmental Statement] should identify existing and proposed land uses near the project, any effects of replacing an existing development or use of the site with the proposed project or preventing a development or use on a neighbouring site from continuing. Applicants should also assess any effects of precluding a new development or use proposed in the development plan.	Section 5.10.5	Details on existing or proposed land uses can be found in section 21.6 and new developments or proposed projects are assessed for potential cumulative impacts in section 21.8.
During any pre-application discussions with the applicant the LPA [Local Planning Authority] should identify any concerns it has about the impacts of the application on land use, having regard to the development plan and relevant applications and including, where relevant, whether it agrees with any independent assessment that the land is surplus to requirements.	Section 5.10.7	Local authorities have provided feedback as part of consultation, section 21.3.
Applicants should seek to minimise impacts on the best and most versatile agricultural land (defined as land in grades 1, 2 and 3a of the Agricultural Land Classification) and preferably use land in areas of poorer quality (grades 3b, 4 and 5) except where this would be inconsistent with other sustainability considerations. Applicants should also identify any effects and seek to minimise impacts on soil quality taking into account any mitigation measures proposed. For developments on previously developed land, applicants should ensure that they have considered the risk posed by land contamination.	Section 5.10.8	See sections 21.6.3, 21.7.1, 21.7.4.2, 21.7.5.2.
The general policies controlling development in the countryside apply with equal force in Green Belts but there is, in addition, a general presumption against inappropriate development within them. Such development should not be approved except in very special circumstances. Applicants should therefore determine whether their proposal, or any part of it, is within an established Green Belt and if it is, whether their proposal may be inappropriate development within the meaning of Green Belt policy (see paragraph 5.10.17 below).	Section 5.10.10	Due to the design principles applied during the early stages of the site selection process, the onshore project area has avoided areas of Green Belt.
An applicant may be able to demonstrate that a particular type of energy infrastructure, such as an underground pipeline, which, in Green Belt policy terms, may be considered as an “engineering operation” rather than a building, is not in the circumstances of the	Section 5.10.12	Due to the design principles applied during the early stages of the site selection process, the onshore project

NPS Requirement	NPS reference	ES reference
application inappropriate development. It may also be possible for an applicant to show that the physical characteristics of a proposed overhead line development or wind farm are such that it has no adverse effects which conflict with the fundamental purposes of Green Belt designation.		area has avoided areas of Green Belt.
Ensure that applicants do not site their scheme on the best and most versatile agricultural land without justification. It should give little weight to the loss of poorer quality agricultural land (in grades 3b, 4 and 5).	Section 5.10.15	See sections 21.6.3, 21.7.1, 21.7.4.2, 21.7.5.2

21.2.2 Local Planning Policy

14. EN-1 states that the Planning Inspectorate will also consider Development Plan Documents or other documents in the Local Development Framework to be relevant to its decision making.

15. The onshore project area falls under the jurisdiction of Norfolk County Council and the following local authorities:

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

16. Within Broadland District there is a Local Plan, which includes the Joint Core Strategy (a partnership between Broadland, Norwich and South Norfolk Councils), the Development Management Development Plan Document (Broadland District Council, 2015) and the Site Allocations (to identify areas for housing, employment, retail, recreation etc.).

17. North Norfolk District Council currently has an Emerging Local Plan 2016-2036, providing the context for development across North Norfolk. Within the Local Plan sit the Core Strategy and Site Allocation Plans setting out more detailed, site specific policies (North Norfolk District Council, 2008, updated 2012).

18. Breckland Council (2011) have an emerging Local Plan 2011-2036. This plan sets out strategic planning policies within Breckland (which replaces the Core Strategy and suite of documents that make up the adopted Local Plan). An updated Emerging Single Local Plan was consulted on in September 2016, with draft documents available online (Breckland Council, 2017).

19. Table 21.2 provides details of the local planning policy documents and the policies contained within these relevant to land use and agriculture.

Table 21.2 Relevant local planning policies

Document	Policy/guidance	Policy/guidance purpose
Norfolk County Council		
Norfolk County Council (2011) Core Strategy and Minerals and Waste Development Management Policies Development Plan Document 2010-2026.	DM16 – Soils.	Development proposals affecting Grade 1 agricultural land will only be permitted in exceptional circumstances, where it is demonstrated that there are no alternative locations for the development.
North Norfolk District Council		
Joint Core Strategy (Broadland, Norwich and South Norfolk) adopted January 2014.	Objective 9	To protect, manage and enhance the natural, built and historic environment, including key landscapes, natural resources and areas of natural habitat or nature conservation value. It is a priority to maintain and improve these special qualities so that everyone can enjoy them. The use of previously developed land will be prioritised to minimise the loss of agricultural land and the countryside. The scale of development we have to accommodate will require the development of some significant greenfield areas, which will affect the existing landscape. Where this is necessary, development must provide environmental gains through green infrastructure, including allotments and community gardens. Biodiversity, geodiversity and locally distinctive landscapes will be protected and enhanced. Linkages between habitats will be promoted, helping to enable adaptation to climate change. Sustainable access to the countryside will be promoted. Efficient use will be made of minerals, energy and water resources, and the production of waste will be minimised.
	Policy 5	The rural economy and diversification will also be supported by: Promotion of farmers markets, farm shops and cottage industry, including the development of a flagship food and farming hub serving the needs of Norfolk and supporting the agri-food sector in and around greater Norwich.
	Policy 7	Healthier lifestyles will be promoted by maximising access by walking and cycling and providing opportunities for social interaction and greater access to green space and the countryside.
	Policy 8	Development will be expected to provide for local cultural and leisure activities, including new or improved built facilities, provide for a range of activities including performance space, and/or access to green space, including formal

Document	Policy/guidance	Policy/guidance purpose
		recreation, country parks and the wider countryside.
	Policy 17	Much of the area is agricultural land forming an attractive backdrop to the existing settlements and the Broads. This area contains many attractive built and natural features including areas of notable landscape character, geological and biodiversity interest. These need to be protected and enhanced, while providing for the rural economy and accessibility to services to be maintained and enhanced. The policy sets out the types of uses that may be acceptable in the countryside. In the case of more significant proposals, these will be considered in the light of their contribution to meeting the overall objectives of the JCS [Joint Core Strategy].
Breckland Council		
Breckland Adopted Core Strategy and Development Control Policies Development Plan Document (Breckland Preferred Sites Sustainability Appraisal, Breckland Local Plan Preferred Directions Consultation Document, Preferred Sites and Settlement Boundaries).	Policy CP8 Natural Resources	All development must be consistent with the principles of the proper management of natural resources. Development will only be supported where it will enhance or protect against the non-essential loss of the natural resources of the District. Whilst mechanisms are in place to ensure that the development needs of the District are met, development should nevertheless avoid the unnecessary loss of high-grade agricultural land which is a finite resource and is important to the rurality of Breckland.
	Proposed Local Plan Policy PD 03	Identifies Attleborough and Thetford as Key Settlements; Dereham, Swaffham and Watton as Market Towns; and 22 other Local Service Centres based on the District's larger villages (Banham, Great Ellingham, Harling, Litcham, Mattishall, Mundford, Narborough, Necton, North Elmham, Old Buckenham, Saham Toney, Shipdham, Swanton Morley, Weeting, Bawdeswell, Beetley, Garboldisham, Hockering, Hockham, Kenninghall, Sporle and Yaxham).
	Preferred Policy Direction (PPD) PD01	The Local Plan will seek and enable development that improves the economic, social and environmental objectives of Breckland through the application of the following national and locally distinctive sustainable development principles: • Mitigate and adapt to climate change; • Protect and enhance the natural, built and historic environment; • Allocate and facilitate developable land that seeks to provide access to homes,

Document	Policy/guidance	Policy/guidance purpose
		employment, retail, leisure and other facilities; • Assist in the creation and maintenance of inclusive, environmentally sustainable communities making the best and most efficient use of previously developed land, buildings and natural resources; Supports Breckland's wider rural economy helping to sustain local services and assist in helping rural communities adapt and grow proportionately to enhance their social and economic sustainability; Directing jobs and growth towards the most sustainable locations contributing towards the economy and jobs in rural areas, helping to find the right balance throughout the District.
	PPD ENV 05	Protection and enhancement of the landscape: The landscape of the District will be protected for the sake of its own intrinsic beauty and its benefit to the rural character and in the interests of biodiversity, geodiversity and historic conservation. Development should have particular regard to maintaining the aesthetic and biodiversity qualities of natural and man-made features within the landscape, including a consideration of individual or groups of natural features such as trees, hedges and woodland or rivers, streams or other topographical features.
	PPD TR01	Sustainable transport network will be achieved through … Encouraging walking and cycling, through links to existing routes, and the provision of facilities such as secure, accessible and bicycle parking with changing facilities on site.
	Policy SW1	Land to the east of Brandon Road and north of the Former Redland Tiles Site Land amounting to approximately 10 hectares is allocated for a residential development of 250 dwellings. A minimum of 0.96 hectares of outdoor sport provision and 0.48 hectares of children's play space will be provided on site along with related landscaping and facilities. Development will be subject to compliance with adopted Core Strategy policies.

Document	Policy/guidance	Policy/guidance purpose
Broadland District Council		
Development Management Development Plan Document.	DPD EN1 – Biodiversity and Habitats	Development proposals will be expected to protect and enhance the biodiversity of the district, avoid fragmentation of habitats, and support the delivery of a co-ordinated green infrastructure network throughout the district.

20. As part of the Norfolk Minerals and Waste Development Framework (Norfolk County Council, 2013), The Core Strategy and Minerals and Waste Development Management Policies Development Plan Document sets out a spatial vision for the provision of mineral extraction and waste management facilities in Norfolk.

21. Mineral safeguard zones are discussed in Chapter 19 Ground Conditions and Contamination.

21.2.3 Guidance

22. There is no specific industry guidance on assessing the impacts of projects on land use and agriculture, therefore a methodology has been developed and consulted on as part of the Norfolk Boreas Land Use and Agriculture Method Statement (RHDHV, 2018, unpublished), for this assessment based on the following sources:

- Highways Agency (2001) Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 6 (Land Use) and Part 11 (Geology & Soils); and
- Ministry of Agriculture, Fisheries and Food (MAFF) (1988) Agricultural Land Classification of England and Wales: Guidelines and Criteria for Grading the Quality of Agricultural Land (Revised Guidelines).

23. In addition to the sources of guidance outlined above there are a number of documents that provide best practice guidance on soil handling and construction management. These offer guidance on methods to reduce the impact on soils and land use, particularly during construction. They are:

- Department for Environment, Food and Rural Affairs (Defra) (2009) Construction Code of Practice for the Sustainable Use of Soils on Construction Sites;
- Defra (1996) Waste Management Duty of Care – A Code of Practice;
- MAFF (2000) Good Practice Guide for Handling Soils;
- MAFF (1991) Practical Guide to Preventing the Spread of Plant and Animal Diseases;
- Environment Agency (2010) Managing Invasive Non-native Plants; and
- Natural England (2012) Agricultural Land Classification: Protecting the Best and Most Versatile Agricultural land.

21.3 Consultation

24. Consultation is a key driver of the EIA and ES 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 land use and agriculture has been conducted through the Scoping Report (Royal HaskoningDHV, 2017) and the Evidence Plan Process (EPP), namely the Land Use and Agriculture Method Statement (Royal HaskoningDHV, 2018, unpublished) and the Preliminary Environmental Information Report (PEIR) (Norfolk Boreas Limited, 2018).

25. Full details of the project consultation process are presented within Chapter 7 Technical Consultation. Ongoing landowner discussions are also being undertaken to help inform the project and have fed into key project design decisions such as the cable route alignment. Whilst individual responses are not captured here, these are collated in the Consultation Report (document reference 5.1), which has been submitted with the DCO application.

26. 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 21.1.

27. A summary of Norfolk Boreas consultation to date that has been used in the development of this land use and agriculture assessment is provided in Table 21.3.

Table 21.3 Consultation Responses received for Norfolk Boreas

Consultee	Document / date received	Comment	Response / where addressed in ES
Secretary of State (SoS)	Scoping Opinion (June 2017)	Responses from Anglian Water, National Grid and the Health and Safety Executive have provided comments relating to the water infrastructure, major hazard sites, electricity and gas infrastructure within the onshore scoping area.	Section 21.6.7 summarises the completed data collection to identify the location of all utilities and the potential impacts are assessed in section 21.7.
SoS	Scoping Opinion (June 2017)	Safeguarded operational, permitted and allocated sand and gravel extraction sites in the onshore scoping area should be identified and considered within the ES.	Mineral safeguard zones are discussed in Chapter 19 Ground Conditions and Contamination.

Consultee	Document / date received	Comment	Response / where addressed in ES
SoS	Scoping Opinion (June 2017)	Careful consideration should be given to the siting of the onshore infrastructure in relation to agricultural land; the potential temporary and permanent loss of ALC land should be assessed and quantified within the ES. Limited information is provided around the approach to the assessment of significance of temporary and permanent loss of agricultural land. The SoS recommends reference to NE's guidance note on the protection of best and most versatile agricultural land (TIN049) in addition to the references citied in paragraph 1092 of the Scoping Report.	Impacts on agricultural activities in relation to ALC-graded land are discussed in section 21.7.4.2. Chapter 4 Site Selection and Assessment of Alternatives provides further information on the considerate siting of project infrastructure.
SoS	Scoping Opinion (June 2017)	The potential for sterilisation of land along the cable route should be assessed within the ES, including interrelated socioeconomic effects. The SoS does not agree that the effects of diversions of PRoW during construction can be scoped out of the assessment given the nature and duration of the proposed works as well as the potential cumulative effect with Norfolk Vanguard. The SoS does recognise that this is scoped in as part of section 4.4 of the Scoping Report (tourism). Cross referencing should be made between these topics as appropriate. Similarly, the SoS notes the applicant's proposal to scope out loss of land during construction with no justification for doing so. The SoS does not agree that this can be scoped out of the assessment (even on the basis that this assessment could be captured as part of the operational loss of land) as the SoS understands the areas of land take associated with construction and operation to be different.	The potential impacts of land sterilisation under construction and operation are discussed in section 21.7.4.4 and 21.7.5.2 respectively. The cumulative effect of this with Norfolk Vanguard are considered in section 21.8. Socioeconomic impacts are considered in Chapter 31.
SoS	Scoping Opinion (June 2017)	The Scoping Report identifies the Norfolk Coast Path, Public Rights of Way and Cycle Trails. Norfolk County Council's response (see Appendix 3 of this Opinion) identifies a number of long distance trails which should be	The potential impacts on Public Rights of Way (PRoW) are discussed in Chapter 30 Tourism and Recreation.

Consultee	Document / date received	Comment	Response / where addressed in ES
		acknowledged e.g. Paston Way and the Weavers Way. Appropriate cross reference should be made to the tourism and recreation chapter of the ES.	
SoS	Scoping Opinion (June 2017)	The potential effects on soil quality should be considered and relevant mitigation measures proposed. The SoS therefore welcomes the proposal for a Soils Management Plan and recommends a draft is provided with the DCO application. The relationship with and role of this plan alongside other relevant plans should also be specified (e.g. if it is to be appended to any CoCP, CEMP or similar and there is to be a separate Materials Management Plan (MMP) as is implied in paragraph 924 of the Scoping Report). These plans should set out sufficient detail as to how the land will be reinstated so as to understand the extent to which they have been relied upon in mitigating potential effects.	The principles upon which the final Soils Management Plan (SMP) will be based prior to construction will be included in the Outline Code of Construction Practise (OCoCP) to be submitted as part of the DCO application. Mitigation measures in relation to soils and drainage are considered in 21.7.4.1 and 21.7.4.4 of this report.
National Grid	Scoping Opinion (June 2017)	We request that the following information be included in the ES: method statement for land reinstatement.	A method statement for the land reinstatement has been included with the ES.
National Grid	Scoping Opinion (June 2017)	Statutory electrical safety clearances must be maintained at all times. Any proposed buildings must not be closer than 5.3m to the lowest conductor. National Grid recommends that no permanent structures are built directly beneath overhead lines. These distances are set out in EN 43 – 8 Technical Specification for "overhead line clearances Issue 3 (2004) available at: http://www.nationalgrid.com/uk/LandandDevelopment/DDC/devnearohl_final/appendixIII/appIII-part2.	The project will be designed in accordance with National Grid recommendations. Norfolk Boreas Limited are working with National Grid to design and consent the Necton National Grid substation extension. Section 21.6.7 summarises the completed data collection to identify the location of all National Grid apparatus.
National Grid	Scoping Opinion (June 2017)	If any changes in ground levels are proposed either beneath or in close proximity to our existing overhead lines then this would serve to reduce the safety clearances for such overhead lines. Safe clearances for	See above response

Consultee	Document / date received	Comment	Response / where addressed in ES
		existing overhead lines must be maintained in all circumstances.	
National Grid	Scoping Opinion (June 2017)	The relevant guidance in relation to working safely near to existing overhead lines is contained within the Health and Safety Executive's (http://www.hse.gov.uk/) Guidance Note GS 6 "Avoidance of Danger from Overhead Electric Lines" and all relevant site staff should make sure that they are both aware of and understand this guidance.	See above response
National Grid	Scoping Opinion (June 2017)	Plant, machinery, equipment, buildings or scaffolding should not encroach within 5.3 metres of any of our high voltage conductors when those conductors are under their worse conditions of maximum "sag" and "swing" and overhead line profile (maximum "sag" and "swing") drawings should be obtained using the contact details above.	See above response
National Grid	Scoping Opinion (June 2017)	If a landscaping scheme is proposed as part of the proposal, we request that only slow and low growing species of trees and shrubs are planted beneath and adjacent to the existing overhead line to reduce the risk of growth to a height which compromises statutory safety clearances.	See above response
National Grid	Scoping Opinion (June 2017)	We would request that the potential impact of the proposed scheme on National Grid's existing assets as set out above is considered in any subsequent reports, including the ES, and as part of any subsequent application. Where any diversion of apparatus may be required to facilitate a scheme, National Grid is unable to give any certainty with the regard to diversions until such time as adequate conceptual design studies have been undertaken by National Grid. Where the promoter intends to acquire land, extinguish rights, or interfere with any of National Grid apparatus, protective provisions will be required in a form acceptable to it	The project will be designed as far as possible to avoid or mitigate any impacts to National Grid assets. Impacts of the project on National Grid Assets are assessed within section 21.7.4 and the ES has expanded on this. Should any interference with National Grid apparatus develop; protective provisions will be included within the DCO following consultation with National Grid.

Consultee	Document / date received	Comment	Response / where addressed in ES
		to be included within the DCO. National Grid requests to be consulted at the earliest stages to ensure that the most appropriate protective provisions are included within the DCO application to safeguard the integrity of the apparatus and to remove the requirement for objection.	
ETG (Norfolk County Council, Breckland Council, Broadland District Council, North Norfolk District Council)	January 2018 Land Use and Agriculture Method Statement	No comments on the proposed methodology received.	No action required
Natural England	Land Use and Agriculture Method statement (Jan 2018)	It should be noted that if any agri-environment schemes are affected then Natural England should be informed. The ES should provide details of how any adverse impacts on soils can be minimised. Further guidance is contained in the Defra Construction Code of Practice for the Sustainable Use of Soil on Development Sites. Please see below for our detailed advice regarding soils and agricultural land quality. We advise that non-agricultural use of the land is also considered rather than just agricultural productivity. This is otherwise outside Natural England's remit and defer to the LA's.	Assessment of potential impacts is included in section 21.7 including impacts on Environmental Stewardship Schemes (ESSs). Mitigation measures in relation to soils and drainage are considered in 21.7.4.1.
ESP Utilities Group Ltd	PEIR (October 2018)	I can confirm that ESP Gas Group Ltd has no gas or electricity apparatus in the vicinity of this site address and will not be affected by your proposed works. ESP are continually laying new gas and electricity networks and this notification is valid for 90 days from the date of this letter. If your proposed works start after this period of time, please re-submit your enquiry.	Potential impacts on Utilities has been assessed in Sections 21.7.4.6 and 21.7.5.6. There will be ongoing consultation with all Utilities providers in the area as required through the post-consent and detailed design phase, prior to construction. Norfolk Boreas Limited would undertake utility crossings in accordance with industry standard practice as agreed with

Consultee	Document / date received	Comment	Response / where addressed in ES
			the utility owners. The continuity of water supplies during the construction works would be ensured.
Harlaxton Gas Networks Ltd.	PEIR (October 2018)	Harlaxton Gas Networks Ltd. at this time has no assets in the area, and will not be implementing any in the near future, therefore Harlaxton has no comment to make on this project.	See above response
National Grid	PEIR (October 2018)	Electricity Transmission National Grid Electricity Transmission has a high voltage electricity overhead transmission line and a high voltage substation within the onshore scoping area. The overhead line and substation form an essential part of the electricity transmission network in England and Wales. Overhead Lines • 4VV (400kV) overhead line route - Norwich Main to Walpole 1 • Norwich Main to Walpole 2 Substation • Necton (400kV) Substation	See above response
National Grid	PEIR (October 2018)	Gas Transmission National Grid Gas has high pressure gas transmission pipelines and gas terminal located within or in close proximity to the onshore scoping area. The transmission pipelines form an essential part of the gas transmission network in England, Wales and Scotland: Gas Transmission Pipelines: • Feeder Main 02 - Bacton to Brisley/ Wisbech Nene West • Feeder Main 03 - Bacton to Roudham Heath • Feeder Main 05 - Bacton to Yelverton	See above response
National Grid	PEIR (October 2018)	We would request that the potential impact of the proposed scheme on National Grid's existing assets as set out in our response is considered in any subsequent reports, including the	See above response

Consultee	Document / date received	Comment	Response / where addressed in ES
		Environmental Statement, and as part of any subsequent application.	
BPA	PEIR (October 2018)	Your proposed works cross the high-pressure gas and gas condensate pipeline systems operated by BPA. Previous consultation responses regarding the Norfolk Vanguard Offshore Wind Farm (2018/0182) mentioned that the works also affected the Great Yarmouth Line (GYPL) on sheet 4 of 18 DWG No 57980-1AG-700-019, however since October BPA no longer maintain this line with all responsibilities transferred to Penspen.	See above response
Anglian Water	PEIR (October 2018)	There is existing water and water recycling assets in Anglian Water's ownership located within the onshore cable area as outlined in the consultation documentation. It is understood that the Norfolk Boreas Offshore Windfarm could come forward together with Norfolk Vanguard Offshore Windfarm or as a separate project. We would expect any requests for alteration or removal of foul sewers or water mains to be conducted in accordance with the Water Industry Act 1991	See above response
Anglian Water	PEIR (October 2018)	We have previously requested that the Environmental Report for the above project includes reference to Anglian Water's existing water and water recycling infrastructure. We welcome the inclusion of reference to existing utility infrastructure including that owned by Anglian Water located within onshore cable route.	See above response
Burgh and Tuttington Parish Council	PEIR (October 2018)	I would like to formally register with you our interest in the Norfolk Boreas project through this consultation process and to outline the concerns of the residents in the parish of Burgh and Tuttington. These concerns are: 1. Traffic disruption in the roads and lanes around Colby and Banningham. 2. Changes in sediment levels in King's Beck or other factors which might	Potential impacts and proposed mitigation on Traffic are discussed in Chapter 24 Traffic and Transportation. Potential impacts on flood risk and pollutants are discussed in Chapter 20 Water Resources and Flood Risk, this is also

Consultee	Document / date received	Comment	Response / where addressed in ES
		affect its flow or flooding downstream. 3. Introduction of pollutants into King's Beck which pass downstream. 4. Any of the above or any other factors which might have a deleterious impact on local industrial activity (principally agriculture) or on the local natural environment affecting living species within or adjacent to King's Beck. Consequently, if during the course of the work any of the above factors come into play - especially those which significantly alter the risks assessed in your documentation - we would like to be informed by you to enable us to consult further with our residents.	assessed in the Flood Risk Assessment (FRA) in Appendix 20.1. Any potential effects on the local agricultural industry have been assessed in section 21.7, in particular, section 21.7.4.2. Any potential effects to the local natural environment and living species are discussed and assessed in Chapter 22 Onshore Ecology.
National Farmers Union	PEIR (October 2018)	The PIER under Chapter 21 Land Use and Agriculture highlights on page 40 that field drainage will be affected during construction and states that field drains will be truncated during excavation and installation. We would like to see greater detail of how field drainage will be treated during construction and post works. For the wording to be agreed with LIG and for this to be included in the Code of Construction under the draft DCO. The landowner will want full engagement on this level of detail and the ability to use a preferred drainage expert.	Potential impacts on drainage and associated mitigation measures are discussed in section 21.7.4.1. This includes the provision of a specialist drainage contractor to provide mapping and figures where appropriate prior to and post construction, to identify field drains and ensure their protection during construction. Handling and protection of soils and drainage systems will be managed through the Soil Management Plan, which will be included within the Code of Construction Practice (CoCP). An outline CoCP (DCO document 8.1) has been submitted as part of the DCO application.
National Farmers Union	PEIR (October 2018)	The PEIR states that the minimum depth of cables would be 1.05 metres.	Norfolk Boreas Limited have committed to

Consultee	Document / date received	Comment	Response / where addressed in ES
		Please be advised that a depth of 1.20 metres is the minimum that can be accepted otherwise the cable will interfere with deep farming operations, the growing of certain crops and interaction with land drains. We note it has been stated that the cables will be laid in accordance to National Grid UK Power Networks ECS 02-0019.	burying the ducts up to 1.20m in ground which is used for "deep ploughing". Table 5.40 in Chapter 5 Project Description makes this commitment which will be taken forward to the DCO application.
National Farmers Union	PEIR (October 2018)	It is noted that a running track up to 8 metres wide may be required on a scenario 2. Please confirm why this width is required. The construction is noted, however there does not appear to be any provision for drainage. How do Vattenfall propose to deal with run off from the running track?	The running track, as described in Chapter 5 Project Description, will be limited to 6m width, which is the minimum distance required for two construction vehicles to pass. A separation of 2m is maintained from the edge of the running track and the trench for safety, drainage and duct storage prior to pulling.
National Farmers Union	PEIR (October 2018)	The PEIR indicates that link boxes will be required and the locations of the link boxes will be required at approximately 5km intervals along the onshore cable route. It states that link boxes would either be buried under ground, or alternatively, above ground link box cabinets may be installed with maximum dimension of 1.2m x 0.8m x 1.8m. Link boxes interfere with agricultural operations on a day to day basis and so every effort should be made for these to be located in field boundaries. LIG would like to see that all link boxes are buried underground with manhole covers and for these to be as close to the ground surface as possible.	These points are noted. Chapter 5 Project Description states that: "where possible, link boxes would be located close to field boundaries and in accessible locations". Given the current level of design detail at this stage of the project it is not possible to provide further information regarding the location and design of link boxes that may be required.
National Farmers Union	PEIR (October 2018)	There have been some discussions with landowners with regard to access points across holdings from the road network to the onshore cable route corridor for Vanguard and it is understood that the same access	It is a correct statement that the same accesses will be used for the Norfolk Vanguard and Norfolk Boreas projects. There are a number of

Consultee	Document / date received	Comment	Response / where addressed in ES
		points will be used for Boreas. Further negotiations with landowners are required as some access points are not viable.	accesses that have been identified in the land plans for both cable pulling construction access and ongoing future maintenance and emergency access purposes. Affected land interests have been consulted on these accesses since September 2017.
National Farmers Union	PEIR (October 2018)	There have been no discussions or details of how landowners will be able to cross the working corridor to gain access to their other land if it has been land locked due to the presence of the corridor. Further consultation is required.	Norfolk Boreas Limited wish to clarify that during both the informal and formal stages of consultation a detailed Land Pack was issued to all affected land interests in June 2017 and March 2018 which contained a number of detailed Q&As relating to the project. This land pack was also made available online on the project website.
National Farmers Union	PEIR (October 2018)	There is considerable concern over EMF and the impact on health. The PEIR is unclear what additional mitigation Vattenfall will be undertaking at the crossing point with Orsted if Orsted use HVAC. Further clarification needed. Greater detail is also required on potential interference on Soil Sense Technology, RTK and other agricultural software.	The analysis of potential EMF effects, undertaken by National Grid for Vattenfall and Ørsted, is presented in two documents that are available on the Vattenfall website. These documents are: Vattenfall EMF-information sheet 4 Vattenfall-Ørsted EMF information sheet 5 Potential impacts associated with EMF are considered in Chapter 27 Human Health.
National Farmers Union	PEIR (October 2018)	Greater clarity is required on how the soils are to be treated, what is the weed control programme, how will the soils be stored, under what conditions will you undertake	Under Scenario 1 there would be very limited impact to soils as the ducts will already have been installed by Norfolk Vanguard. Under

Consultee	Document / date received	Comment	Response / where addressed in ES
		reinstatement, how do you propose to reinstate? What topographical and geological analysis will be undertaken? What aftercare programme will be set up? Due to the diverse range of soil types confirmation is required that the land will be worked on in the appropriate conditions ie. working on heavier land in the Summer months and lighter land in Spring and Autumn. This will ensure that the land is reinstated and given the best opportunity to recover following the works. We understand re-instatement will be phased in line with duct installation, please confirm.	Scenario 2 each 150m (circa) section of duct installation along the cable route would take approximately one to two weeks to complete and the land above the ducts reinstated, thus giving soil the best opportunity to recover. At this stage of the project, Norfolk Boreas have made no commitment to working on different sections of the cable route during different seasons. Norfolk Boreas Limited have made a commitment to providing a SMP which will form part of the CoCP, an outline of which (DCO document 8.1) has been submitted as part of the DCO application. This document would then be finalised post consent and agreed with the relevant local authorities. An aerial photogrammetry topological survey of the onshore cable route was undertaken in February 2017. Geological boreholes have been conducted at proposed trenchless crossing locations along the cable route and desktop research of other relevant geological data along the cable route has been conducted. Further geological surveys will be undertaken as part of pre-construction surveys as necessary.

Consultee	Document / date received	Comment	Response / where addressed in ES
National Farmers Union	PEIR (October 2018)	Recent field trials have shown that cereal crops have a root depth in excess of a metre. What will be the impact of the cables be on growing crops?	Potential impacts on crops along the onshore cable route during operation are assessed in section 21.7.5.2.1
National Farmers Union	PEIR (October 2018)	There are a number of HDD points along the route and greater clarification is sought on the procedures to be adopted to respond to any drilling fluid breakout.	Drilling fluids will be of an inert form, typically bentonite or similar which is a mixture of mainly water and a small percentage of natural clays, to minimise the impact of any breakout. Chapter 20 Water Resources and Flood Risk details outline mitigation measures to manage the accidental release of contaminants during construction. Further details, including method statements to manage drilling fluid breakout, will be provided within a final CoCP. An outline CoCP (DCO document 8.1) has been submitted as part of the DCO application.

21.4 Assessment Methodology

21.4.1 Impact Assessment Methodology

28. Chapter 6 EIA Methodology details the general impact assessment method, and the following sections describe more specifically the methodology used to assess the potential impacts of the project on land use and agriculture. This methodology has been consulted and agreed via the Scoping Report (Royal HaskoningDHV, 2017) and the Preliminary Environmental Information Report (PEIR) (Norfolk Boreas Limited, 2018).

29. Two key groups of impacts have been identified for the purpose of defining receptor sensitivity and impact magnitude in this assessment:

- Land use and tenure: these are the potential impacts on human beings, including landowners, occupiers, local communities and other land users. Potential impacts on land users in relation to tourism and recreational activities such as cycle routes, PRoW and national trails are considered in Chapter 30 Tourism and Recreation; and
- Agriculture: these are potential impacts on the bio-physical elements of soils, the surrounding environment and the productivity of the land. The focus of the assessment in this chapter is on agricultural productivity and soil resource. Geology, ground conditions and contamination are considered in Chapter 19 Ground Conditions and Contamination.

30. Whilst there are clear links between the two impact groups, the assessment of receptor sensitivity and magnitude of effect will differ.

31. The scope of the assessment for land use and agricultural environment identifies the existing environment, as characterised by the following:

- Land use policies and designations;
- Agricultural activities;
- Agricultural Land Classification (ALC) system;
- Soil type;
- Environmental Stewardship Schemes (ESSs);
- Injurious weeds and invasive plant species;
- Utilities; and
- Open access and common land.

32. ALC grades and descriptions are shown in Table 21.4.

Table 21.4 ALC grades[12] and descriptions

Grade	Description
Grade 1 – Excellent Quality Agricultural Land	Land with no or very minor limitations to agricultural use. A very wide range of agricultural and horticultural crops can be grown and commonly includes top fruit, soft fruit, salad crops and winter harvested vegetables. Yields are high and less variable than on land of lower quality.
Grade 2 – Very Good Quality Agricultural Land	Land with minor limitations which affect crop yield, cultivations or harvesting. A wide range of agricultural and horticultural crops can usually be grown but on some land in the grade there may be reduced flexibility due to difficulties with the production of the more demanding crops such as winter harvested vegetables and arable root crops. The level of yield is generally high but may be lower or more variable than Grade 1.
Grade 3 – Good to Moderate Quality Agricultural Land	Land with moderate limitations which affect the choice of crops, timing and type of cultivation, harvesting or the level of yield. Where more demanding crops are grown yields are generally lower or more variable than on land in Grades 1 and 2.
Subgrade 3a – Good Quality Agricultural Land	*Land capable of consistently producing moderate to high yields of a narrow range of arable crops, especially cereals, or moderate yields of a wide range of crops including cereals, grass, oilseed rape, potatoes, sugar beet and the less demanding horticultural crops.*
Subgrade 3b– Moderate Quality Agricultural Land	*Land capable of producing moderate yields of a narrow range of crops, principally cereals and grass or lower yields of a wider range of crops or high yields of grass which can be grazed or harvested over most of the year.*
Grade 4 – Poor Quality Agricultural Land	Land with severe limitations, which significantly restrict the range of crops and / or level of yields. It is mainly suited to grass with occasional arable crops (e.g. cereals and forage crops) the yields of which are variable. In moist climates, yields of grass may be moderate to high but there may be difficulties in utilisation. The grade also includes very droughty arable land.
Grade 5 – Very Poor Quality Agricultural Land	Land with very severe limitations, which restrict use to permanent pasture or rough grazing, except for occasional pioneer forage crops.
Urban	Built-up or 'hard' uses with relatively little potential for a return to agriculture including: housing, industry, commerce, education, transport, religious buildings, and cemeteries. Also, hard-surfaced sports facilities, permanent caravan sites and vacant land; all types of derelict land, including mineral workings which are only likely to be reclaimed using derelict land grants.

33. The Natural England ALC dataset no longer differentiates between grade 3a and 3b agricultural land. As a precautionary worst case approach, for the purpose of this

[1] Source: Agricultural Land Classification of England and Wales, Ministry of Agriculture, Fisheries and Food, 1988 [online]. Available at: http://webarchive.nationalarchives.gov.uk/20130402200910/http://archive.defra.gov.uk/foodfarm/landmanage/land-use/documents/alc-guidelines-1988.pdf [Accessed 17/04/2017].

[2] The Natural England ALC dataset no longer differentiates between grade 3a and 3b agricultural land. As a worst case it is assumed that all grade 3 land permanently lost could be grade 3a and therefore of high sensitivity.

assessment it is assumed all grade 3 land could be grade 3a and therefore of high sensitivity.

34. The sensitivity of receptors is assessed according to the criteria set out in Table 21.5 and is based on the capacity of receptors to tolerate change and whether or not increased risks would be acceptable within the scope of the prevailing legislation and guidelines. The degree of change that is considered to be acceptable is dependent on the susceptibility of the receptor to the change that the project would have on the land use.

Table 21.5 Definitions of sensitivity levels for land use receptors

Sensitivity	Land use and tenure	Agriculture and soils
High	Receptor has no or very limited capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• Higher level ESSs; • Future planning applications for large scale planning uses; • Internationally and nationally designated planning policy areas; or • Land uses that are not possible elsewhere or regionally scarce and cannot be adapted or replaced e.g. the ecosystem service functions of soils.	• ALC Grade 1,2 or 3a land; • Farming practices with specific requirements; • Land with Notifiable Weeds (risk of spread) • Land with notifiable Scheduled diseases (risk of spread); or • Soil vulnerable to structural damage and erosion or unrecoverable or not adaptable to changes.
Medium	Receptor has limited capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• Entry level or Entry Level with Higher ESS; or • Local designated planning policy areas.	• ALC Grade 3b; or • Seasonally susceptible to structural damage or erosion.
Low	Receptor has moderate capacity to accommodate changes to the land use such as loss of land areas, soil degradation etc.	
	• No designated planning policy areas; • No ESS's but under other environmental management; • Land used for ordinary agriculture or horticulture; or • Large agricultural holdings.	• ALC Grade 4 land; • Arable or pasture grassland; or • Medium to course material, some resistance to structural damage the majority of the year.
Negligible	Receptor generally tolerant of changes to the land use such as loss of land areas, soil degradation etc.	
	• No designated planning policy areas; or • No ESS.	• ALC Grade 5 land; • Non-agricultural and urban, non-arable or pasture grassland; or • Greater resistance to soil structural damage.

21.4.1.1 Magnitude

35. Potential impacts may be adverse, beneficial or neutral. Impact magnitude on a receptor has been defined with consideration of the spatial extent, duration,

frequency and severity of the effect. Impact magnitude is assessed qualitatively according to the criteria defined in Table 21.6.

36. The following definitions apply to the time periods used in the magnitude assessment:

- Long term: Greater than 5 years;
- Medium term: 2 to 5 years; and
- Short term: Less than 2 years.

37. Based on the above definitions, construction-related impacts are considered a short term impact magnitude within the assessment and relate to impacts that do not extend past the construction period.

Table 21.6 Definitions of magnitude levels for land use receptors

Magnitude	Land use and tenure	Agriculture and soils
High	• Permanent (>10 years) / irreversible changes, over the whole receptor, affecting usability, risk, value over a wide area, or certain to affect regulatory compliance.	• Permanent loss of over 20ha of the Best and Most Versatile (BMV) agricultural land (grades 1,2 and 3a) or more than 60% total regional resource (Natural England, 2012a); • Full recovery of land would take more than 10 years; or • Existing land use would not be able to continue on more than 5ha of land or the entire landowner/occupiers available land (where smaller) where the land would be rendered unviable for agricultural purposes OR permanent changes to land management would be required.
Medium	• Moderate permanent or long-term (5-10 years) reversible changes, over the majority of the receptor, affecting usability, risk, value over the local area, possibly affecting regulatory compliance; • Existing land use would not be able to continue on less than 5ha of land or • Noticeable changes to the existing land use although it may continue.	• Medium to long term loss of more than 20ha of the BMV agricultural land or more than 60% of the regional resource; • Permanent loss of more than 10ha of ALC (grade 3b) agricultural land; • Full recovery of land is expected within 5 to 10 years; • More than 20ha of soil is temporarily unsuitable for agriculture or • Small areas (<10ha) of any agricultural land permanently lost from agriculture
Low	• Temporary change affecting usability, risk or value over the short-term (<5 years); or • Temporary change affecting usability within the site boundary; measurable permanent change with minimal effect usability, risk or value; no effect on regulatory compliance.	• Short term loss of more than 20ha, or permanent loss of more than 10ha of ALC Grade 4 land or more than 10% of regional resource; • Full recovery of land is expected within 5 years; or • Less than 20ha of soil is temporarily unsuitable for agriculture or less than 1ha is permanently lost from agriculture.
Negligible	• Minor permanent or temporary change, undiscernible over the medium- to long-term short-term,	• No material change to the soil resource has been identified or

Magnitude	Land use and tenure	Agriculture and soils
	with no effect on usability, risk or value.	• Small areas <1,000m^2 is permanently lost from agriculture

21.4.1.2 Impact significance

38. Following the identification of receptor sensitivity and magnitude of the effect, it is possible to determine the significance of the impact. A matrix is presented in Table 21.7 and will be used wherever relevant. Assessment of impact significance is qualitative and reliant on professional experience, interpretation and judgement. The matrix should therefore be viewed as a framework to aid understanding of how a judgement has been reached, rather than as a prescriptive tool.

Table 21.7 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*

39. As with the definitions of magnitude and sensitivity, the matrix used for land use and agriculture is defined and the impact significance categories are divided as shown in Table 21.8.

Table 21.8 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.

40. 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, it is important

to distinguish these from other non-significant impacts as they may contribute to significant impacts cumulatively or through interactions.

41. Embedded mitigation is included in the initial assessment of impact. If the impact does not require mitigation (or none is possible) the residual impact will remain the same. If additional mitigation is required or is considered best practice which the project will employ, there will also be an assessment of the post-mitigation residual impact.

21.4.2 Cumulative Impact Assessment

42. Chapter 6 EIA Methodology provides a general methodology with regards to the CIA.

43. The potential for cumulative effects has been considered for the construction, operation and decommissioning of the onshore project area cumulatively with the offshore project area as well as with other onshore projects.

44. Cumulative impacts are discussed where the onshore project area has the potential to overlap with similar impacts arising from:

- Existing development, either built or under construction;
- Approved development, awaiting implementation; and
- Proposals awaiting determination within the planning process with design information in the public domain.

45. The CIA involves consideration of whether impacts on a receptor can occur on a cumulative basis between the project and other activities, projects and plans for which sufficient information regarding location and scale exist.

46. For further details of the methods used for the CIA for land use and agriculture, see section 21.8.

21.4.3 Transboundary Impact Assessment

47. There are no transboundary impacts with regards to land use and agriculture as the onshore project area is entirely within the UK and would not be sited in proximity to any international boundaries. Transboundary impacts are therefore scoped out of this assessment and will not be considered further.

21.5 Scope

21.5.1 Study Area

48. The onshore project area includes the following elements:

- Landfall;

- Onshore cable route, accesses, trenchless crossing techniques (e.g. Horizontal Directional Drilling (HDD)) and mobilisation areas;
- Onshore project substation; and
- Extension to the Necton National Grid substation and overhead line modification.

49. A full description of the above onshore infrastructure is provided in Chapter 5 Project Description.

50. For the purpose of this assessment, and to aid the baseline descriptions, study areas have been determined by a number of factors such as the distribution of receptors, footprint of potential impact and political/management boundaries, and were consulted on as part of the EPP namely the Land Use and Agriculture Method Statement (Royal HaskoningDHV, 2018, unpublished) and the PEIR (Norfolk Boreas Limited, 2018).

51. The following study areas have been defined to assess the direct and indirect impacts associated with the project:

- Onshore project area: as outlined in Chapter 5 Project Description. This is considered to be the largest area over which direct impacts (e.g. loss of land, soil degradation) would be experienced;
- Local or parish boundary: this study area is used to assess direct and indirect impacts and provides the first point on the scale to assess impacts at a local level. For example, the onshore project substation will be located in the Necton parish;
- Local authority boundary: this is the study area for direct and indirect impacts and provides the second point on the scale to put impacts into the district context. This incorporates the entire boroughs of Breckland, Broadland and North Norfolk. This has been selected as this is the spatial level at which local plan policy is made and development objectives are applicable as the local authorities; and
- County boundary is used to assess indirect impacts and provides the third point on the scale to assess impacts at a county level of Norfolk, for example to identify impacts on the agricultural industry (e.g. agricultural productivity). The onshore project area is wholly within the county of Norfolk.

52. The onshore project area boundary and local parish and local authority boundaries are shown Figure 21.1.

21.5.2 Data Sources

53. The data sources used to inform the land use and agricultural baseline, and the confidence levels associated with each data source, are listed in Table 21.9.

Table 21.9 Data sources

Data	Source	Year	Coverage	Confidence	Notes
'A' Roads, Railway Lines and Urban Area	Ordnance Survey	2016	Landfall, onshore cable route, onshore project substation	High	N/A
Datasets on the structure of the agricultural industry	Defra	2013-2015	Norfolk	High	N/A
Soil types	Cranfield University	2017	Landfall, onshore cable route, onshore project substation	High	N/A
Invasive species	Biological records and Phase 1 surveys	2017	Landfall, onshore cable route, onshore project substation	High	N/A
The June Survey of Agricultural and Horticultural Activity.	Defra	2013	Norfolk	High	2016 survey was not broken down into regions, therefore 2013 last detailed information currently available
ALC and agri-environment schemes	Natural England	2015	England and Wales	High	Locations and details
Agricultural activities	Land agents	2017	Norfolk	Medium	High level qualitative data on agricultural activities in Norfolk and specific to the study area
Utilities search e.g. high pressure gas pipelines	EMAP, GHD	2014, 2017 and 2018	Landfall, onshore cable route and onshore project substation	High	Locations and details
Breckland Adopted Core Strategy and Development Control Policies Development Plan Document	Breckland Council	2011 and 2016	Onshore cable route, onshore project substation	High	N/A
Broadland District	Broadland District Council	2015	Onshore cable route	High	N/A

Data	Source	Year	Coverage	Confidence	Notes
Development Management Development Plan					
North Norfolk Core Strategy (2008) to 2021	North Norfolk District Council	2008 (updated 2012)	Onshore cable route	High	N/A
Joint Core Strategy (Broadland, Norwich and South Norfolk)	Broadland District Council, North Norfolk District Council	2014	Onshore cable route	High	N/A

21.6 Existing Environment

54. This section describes the existing environment in relation to land use and agriculture. It is based on a desk-top study of sources identified in Table 21.9 as a basis for the impact assessment.

55. Norfolk is a rural county with 53% of its population designated as living in rural areas (Norfolk Rural Development Strategy, 2013). The primary land use within the area covered by the onshore project area is agricultural (Figure 21.2). Within the vicinity of the onshore project area there are a number of rural towns and villages. Urban areas including Dereham, Aylsham, Reepham and North Walsham are adjacent to, but outside of, the onshore project area.

56. The onshore cable route and onshore project substation (including the National Grid substation extension) and landfall are all located within primarily agricultural land, with some areas of improved or semi-improved grassland, mixed deciduous woodland, coniferous plantations, hedgerows and waterbodies. Further information on the habitats and ecology of the onshore project area can be found in Chapter 22 Onshore Ecology.

57. The Dudgeon Offshore Wind Farm onshore substation is immediately adjacent to the Necton National Grid substation extension, and just under 1km from the onshore project substation.

58. The site selection process for the onshore cable route has been developed in adherence with key design principles of routing in order to minimise impacts where possible. This includes avoiding areas of woodland, urban areas, and sites designated for nature conservation or cultural heritage. For further information please see section 21.7.1 for mitigation that has been embedded into the project design, and Chapter 4 Site Selection and Assessment of Alternatives.

21.6.1 Land Use and Agriculture Policies and Designations

59. A review of Breckland Council, Broadland District Council and North Norfolk District Council local plans was undertaken to identify any parcels of land that are allocated for, or restrict, future development or change of use. This included a review of the proposals map for each of the local authorities.

60. The relevant planning policies in relation to land use and agriculture are outlined in section 21.2.2.

61. The onshore project substation and onshore cable route through the Breckland District do not cross any preferred or alternative sites designated for housing (Breckland Council, 2016). Breckland Policy SW1 has been highlighted in Table 21.2 due to the potential for cumulative impacts to occur as a result of the project under Policy SW1. This is assessed in section 21.8.

62. The onshore cable route through Breckland crosses the following County Wildlife Sites; Land South of Dillington Carr, Little Wood north of Dereham, the Wendling Carr west of Dereham and passes next to Necton Wood at Necton (Figure 21.3).

63. Within the Broadland District the onshore cable route passes across an area designated for conservation (under Planning Policy EN2), north of Aylsham to the east of the River Bure (Broadland District Council, 2015), and the Marriott's Way County Wildlife Site west of Reepham (Figure 21.3). In addition, there is a proposed County Wildlife Site which, if it receives designation, will be located within the onshore project area at Kerdiston between Kerdiston Hall and the Marriott's Way ('Kerdiston Old Hall Meadows').

64. North Norfolk District Council identify Happisburgh within their Core Strategy as a Coastal Service Village, ensuring development supports local communities in the face of coastal erosion and flood risk; and North Walsham as a Principal Settlement, along with Cromer, Holt and Fakenham. The majority of commercial and residential development will take place in these Principal Settlement areas (75% of new employment land and 50% of new homes). The landfall is immediately to the south of Happisburgh, and the onshore cable route passes immediately to the north of North Walsham and passes through the Paston Way and Knapton Cutting County Wildlife Site (Figure 21.3).

65. Policies and designations relevant to land use and agriculture in relation to the onshore project area are shown on Figure 21.3.

21.6.2 Agricultural Activities

66. This section describes the baseline environment in terms of agricultural land cover, including the crops grown and agricultural practices adopted where these are

known. It should be noted that this assessment is based on high level datasets which are only accurate at the time of data collection, and therefore should only be considered indicative of the land uses found within the study areas.

67. Agriculture in Norfolk is primarily arable or mixed use. Farm sizes range from less than 5ha to more than 100ha (Defra, 2013). Soil types vary from clays, loam to light sands. Crops grown include cereals and combinable crops (wheat, barley, and oil seed rape) and root crops (sugar beet and potatoes and vegetable crops) (Consents Solutions, 2017). Other agricultural land uses within the study area include rhubarb farming, long term crops such as plantations and poultry, pig and dairy farming.

68. Norfolk contains over 5% of the total of the agricultural sector in England (Norfolk Rural Development Strategy Steering Group, 2013). The rural economy in Norfolk accounts for 44% of jobs and has the largest agricultural sector of any English county, with a Gross Added Value (GVA)[3] of £50,000 per job and is therefore an important part of the county's economy (Norfolk Rural Development Strategy, 2013).

69. The total area of farmed land in Norfolk as of 2013[4] is 411,085ha (Defra, 2013). The footprint of agricultural land in the onshore project area constitutes approximately 0.1% of the county resource.

70. Field drainage systems are a vital part of agriculture in Norfolk and made of ceramic, clay or other materials. In some cases, these systems are not mapped.

21.6.3 Agricultural Land Classification

71. Agricultural land in England and Wales has been classified according to the quality and versatility of soil in a grading system (the ALC), and is based on factors including climate, nature of the soil and site-based factors (MAFF, 1988). It is a national system in which maps have been produced for the whole of England and Wales. The grading system was defined by the former MAFF (now Defra), and is described in Table 21.4. Land across the onshore project area ranges from ALC grades 1 to 4 (Figure 21.4).

72. The onshore cable route from landfall to the onshore grid connection at the Necton National Grid substation crosses ALC grades 1-4, primarily consisting of ALC Grade 2 and 3. The landfall at Happisburgh South and some of the onshore cable route crosses ALC Grade 1. The majority of the onshore cable route and mobilisation zones cross ALC Grades 2 and 3. North east of Dereham, the onshore cable route

[3] Gross value added is the measure of the value of goods and services produced in an area, industry or sector
[4] County level breakdowns are now only available in years that correspond to the EU Farm Structure Survey. The latest available county results are for 2010 and 2013. The next updates will relate to 2016 and then 2020. At the time of writing these were not yet available. For interim years, regional level data is now supplied.

crosses some ALC Grade 4 land and at the eastern end and at landfall crosses ALC Grade 1 land.

73. The existing land at the onshore project substation comprises ALC Grade 3, with the temporary construction area for the National Grid substation extension zone including the overhead line modifications located within Grade 2 and 3 land. The permanent footprint of the National Grid substation extension and overhead line modifications are entirely within ALC Grade 2 land.

74. The Natural England ALC dataset no longer differentiates between grade 3a and 3b agricultural land. As a worst case, it is assumed that all grade 3 land impacted by the project could be grade 3a and therefore of high sensitivity.

75. The percentage of land of different ALC grades within the onshore project area is presented in Table 21.10. Figure 21.4 contains information on the ALC graded areas over the onshore project area.

Table 21.10 Percentage of land of different ALC grades within the onshore red line boundary

ALC grade	Hectares ALC grade land within onshore red line boundary	% ALC grade land within onshore red line boundary[5]	ALC grade land within onshore project area as a % of total ALC grade land in Norfolk County
1	52.6	9.4	0.115
2	159.2	28.4	0.18
3 (all to be considered as 3a)	294.3	52.5	0.098
4	5.6	1.0	0.012
5	0	0	0
Non-agricultural/urban[6]	1.5	0.29	0.003

21.6.4 Soil Type

76. This section provides a description of the soils found within the direct study area in relation to the type, drainage, texture, fertility, moisture and expected land cover. Chapter 20 Water Resources and Flood Risk provides further details on soils in relation to flood risk, water and local drainage.

77. Any impact on the soil resource is not predicted to extend beyond the direct study area, therefore impacts to the wider county level study areas are not discussed. It

[5] The onshore red line boundary extends slightly offshore, this area has not be accounted for in the calculations therefore the total is less than 100%.
[6] This small area is taking account of roads and tracks that intersect the onshore cable route. See Chapter 5 Project Description Table 5.33 for information on crossing techniques.

should be noted that the published soil data provides generic characteristics and are indicative of the soil type present. The precise soil type and characteristics will differ between and within individual fields and these have been verified by the ground investigations survey undertaken in 2017 (see Chapter 19 Ground Conditions and Contamination).

78. The soils within the direct study area are dominated by acidic, loamy soils around the landfall and in the east of the onshore cable route and acidic, loamy and clayey soils in the west around the onshore project substation. The soils are from low natural fertility (without the addition of fertilisers) in the east to moderate to the west and around the onshore project substation.

79. Table 21.11 provides additional detail on the characteristics of the soil types found within the study area (National Soil Resources Institute (NSRI), undated).

Table 21.11 Soil types within the onshore project area

Freely draining slightly acid loamy soils	
Typical Habitats (Semi-natural vegetation).	Neutral and acid pastures and deciduous woodlands; acid communities such as bracken and gorse in the uplands.
Texture.	Loamy.
Drainage type.	Freely draining.
Natural fertility.	Low.
Slowly permeable seasonally wet acid loamy and clayey soils	
Typical Habitats (Semi-natural vegetation).	Seasonally wet pastures and woodlands mainly, but not exclusively, on the upland fringe.
Texture.	Loamy.
Drainage type.	Impeded drainage.
Natural fertility.	Low.
Loamy and sandy soils with naturally high groundwater and a peaty surface	
Typical Habitats (Semi-natural vegetation)	Wet meadows and pastures with wet fen communities.
Texture	Peaty.
Drainage type	Naturally wet.
Natural fertility	Low to high.
Slightly acid loamy and clayey soils with impeded drainage	
Typical Habitats (Semi-natural vegetation)	Wide range of pasture and generally broadleaved and mixed woodland types
Texture	Loamy
Drainage type	Slightly impeded drainage
Natural fertility	Moderate to high

Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils	
Typical Habitats (Semi-natural vegetation)	Lowland seasonally wet pastures and woodlands
Texture	Loamy
Drainage type	Impeded drainage
Natural fertility	Moderate
Freely draining slightly acid sandy soils	
Typical Habitats (Semi-natural vegetation)	Freely draining slightly acid sandy soils
Texture	Sandy
Drainage type	Freely draining
Natural fertility	Low

80. The NSRI provides a classification for Expected Crops and Land Use based on land uses and land cover commonly associated with individual soil types. Those relevant to the study area are:

- Suitable for a range of spring and autumn sown crops; under grass the soils have a long grazing season. Free drainage reduces the risk of soil damage from grazing animals or farm machinery. Shortage of soil moisture most likely limiting factor on yields, particularly where stony or shallow;
- Mostly suited to grass production for dairying or beef; some cereal production often for feed. Timeliness of stocking and fieldwork is important, and wet ground conditions should be avoided at the beginning and end of the growing season to prevent damage to soil structure. Land is tile drained and periodic moling or subsoiling will assist drainage;
- Cereals, roots, potatoes and field vegetables provided groundwater is controlled. Ease of working and winter harvesting, which can be damaging to structure, dependent on texture and drainage of subsoil. Irrigation needed on lighter soils;
- Suitable for wide range of spring and autumn sown crops including irrigated roots, potatoes and field vegetables; lime and fertiliser rapidly leached; shortage of soil moisture will limit yield without irrigation;
- Reasonably flexible but more suited to autumn sown crops and grassland; soil conditions may limit safe groundwork and grazing, particularly in spring; and Mostly suited to grass production for dairying or beef; some cereal production often for feed. Timeliness of stocking and fieldwork is important, and wet ground conditions should be avoided at the beginning and end of the growing season to avoid damage to soil structure. Land is tile drained and periodic moling or subsoiling will assist drainage.

21.6.4.1.1 Soil natural capital, ecosystem services and carbon resource

81. The concepts of 'natural capital' and 'ecosystem services' are used to bring together scientific and economic considerations so that the potential impact of ecosystem modification and the way it may affect society can be assessed more fully. Natural capital in the context of soils can be considered in terms of the mass, energy and entropy (organisation) stored within the soil. Soil ecosystem services refer to the functions and processes through which soils produce resources used by humans. These are summarised in Table 21.12.

Table 21.12 Soil natural capital and ecosystem services

Mass (constituents of the soil matrix)	Description
Mass (constituents of the soil matrix)	Inorganic content (minerals and nutrients); Organic content (carbon and organisms); Water; and Air.
Energy	Temperature and biomass.
Entropy (organisation)	Soil physical and chemical structure; Organisation of biological populations, food webs and biodiversity; and Spatial and temporal structure.
Soil Ecosystem Services	**Description**
Support functions	Supporting food and fibre production, ecological habitat and diversity through: Physical stability and medium for supporting plants; Supply of plant nutrients; and Role as habitat and gene pool/seed bank.
Regulation functions	Regulation of major elemental cycles – macronutrients (N, P and K) and micronutrients; Regulation and buffering of the hydrological cycle and attenuation of pollutants; and Regulation/cycling of organic matter (waste decomposition and carbon cycle.
Provisioning functions	Use as a raw material for development; and Providing a platform for development.
Cultural functions	Repository for, and protection of, archaeological artefacts and structures of heritage value; and Location of religious/spiritually significant sites/structures (e.g. burial grounds).

82. Soils hold a large reserve of organic carbon, which may be lost as a result of land use change and changes as a result of human activity (including climate change), resulting in the release of greenhouse gases. This may also impact other ecosystem services such as food security, biodiversity and the storage of water. Conversely, agricultural management practices and the use of waste materials may allow more carbon to be stored in soils. It should be noted, however, that currently evidence of a direct linkage between land management activities, changes in soil carbon and greenhouse gas emissions is poor. The highest concentration of carbon storage is in blanket peats. These are not found within the study area.

83. Over 95% of the UK land carbon stock is held within the soil, an estimated 9.8±2.4 billion tonnes, of which 2.8 billion tonnes is held in England and Wales. Whilst bog habitats were found to have by far the greatest average carbon content, grassland was estimated to hold approximately 32.4% of topsoil carbon stocks. The smallest amounts of carbon were found in arable/horticultural soils (Ostle *et al.,* 2009).

84. Carbon in live vegetation is estimated to account for five percent or less of the UK land carbon stock, of which forests and woodland (including natural woodland and plantations) account for approximately 80% (Ostle *et al*., 2009). An Ecosystem Services Assessment has been produced as part of this ES (Chapter 22 Onshore Ecology Appendix 22.10 Ecosystem Services Assessment), and therefore ecosystem services are not considered further in this chapter.

21.6.5 Environment Stewardship Schemes

85. ESSs provide funding and advice to farmers, tenants and other land managers to encourage effective environmental management of land (Natural England, 2015). ESS were a key tool for the delivery of the Rural Development Programme for England 2007-2013, funded by the European Union and UK Government. The 2014-2020 Rural Development Programme for England attempts to build on and enhance the ESS by providing funding to protect 14,000ha of woodland and targeting specific biodiversity and water objectives (European Commission, 2017). The schemes are administered by Natural England for Defra.

86. There are three levels to the scheme:

- Entry Level Stewardship (ELS) – includes Uplands ELS (UELS): simple and effective land management agreements with priority options;
- Organic Entry Level Stewardship (OELS) – includes Uplands OELS: organic and conventional mixed farming agreements; and
- Higher Level Stewardship (HLS): more complex types of management and agreements tailored to local circumstances.

87. There are 1,629 land management agreements in rural Norfolk supported by agri-environment schemes on 307,000ha (56% of the county) (Norfolk Rural Development Strategy Steering Group, 2013).

88. The total percentage of land signed up to the ESS crossed by the onshore project area is 0.08% of all ESS in Norfolk as a whole (Norfolk Rural Development Strategy Steering Group, 2013).

89. The location of the ESS agreements within the onshore project area are shown in Figure 21.5.

90. The onshore project substation and National Grid substation extension including the overhead line modification is not situated on land subject to any ESS, however the onshore project area crosses Entry Level (1.26, 0.23% of the onshore project area) and Entry Level plus Higher Level (117.6ha, 21.4% of the onshore project area) Stewardship Scheme agreements and therefore elements of the construction, operation and decommissioning of the onshore cable route such as trenching, cable installation and link boxes that could potentially impact on land under an ESS agreement will be considered.

21.6.6 Injurious Weeds and Invasive Plant Species

91. The Phase 1 habitat survey in 2017 recorded two non-native invasive species listed on the Wildlife and Countryside Act 1981 Schedule 9. These were Japanese knotweed *Fallopia japonica* and Giant Hogweed *Heracleum mantegazzianum*. These were recorded at TG 20026 28956 and TF 90572 09388 respectively. These are shown on Figure 22.5 in Chapter 22 Onshore Ecology.

92. Japanese knotweed records were also identified through a biological records check[7], which show it to be found at the following locations:

- TG2006428426 - Drabblegate, Aylsham;
- TG3409431895 - Mill Common Road, North Walsham; and
- TG20082848 - Drabblegate, Aylsham.

21.6.7 Utilities

93. There are a number of utilities that are located along the onshore cable route, as identified by a commissioned utilities search undertaken in 2017 and updated in 2018 by engineering consultants GHD (Figure 21.6[8]). These include major and minor (domestic) utilities, with domestic utilities often being routed under the public highway.

94. The majority of the identified utilities crossing the onshore cable route are related to domestic services for gas, electricity, water and sewerage connections, including the buried high pressure gas pipeline running from the Bacton terminal heading to the west and south west. Sheringham Shoal Offshore Wind Farm underground cables (from Saxthorpe to Cawston) run through the onshore cable route.

95. The Dudgeon Offshore Wind Farm underground cable route comes into the Necton National Grid substation from the north west and under Scenario 2 crosses the onshore 400kV cable route as it enters the National Grid substation extension to the

[7] Due to copyright reasons, biological records cannot be reproduced in a figure.
[8] It is acknowledged that Ørsted are developing the Hornsea Project Three Offshore Wind Farm. This project is considered under the CIA and is therefore not part of the existing utilities baseline for Norfolk Boreas.

west (Figure 21.6). Under Scenario 1 the Norfolk Vanguard cables will be installed along the cable route from landfall to the Norfolk Vanguard substation, along with the onshore 400kV cables from the Norfolk Vanguard substation to the existing Necton National Grid substation.

96. Table 21.13 provides information of the utilities of major and national importance that cross the onshore project area.

Table 21.13 Major utilities located within the onshore project area

Utility type	Provider
Gas	BPA, CADENT, National Grid UK
Telecoms	BT Telecoms, Vodafone, Virgin Media
Electricity	National Grid UK, Dudgeon Offshore Wind Limited, Sheringham Shoal Offshore Wind Ltd, UKPN, Norfolk Vanguard Limited (under Scenario 1)
Water and Sewage	Anglian Water
Drainage	WMA

Source: compiled by GHD Limited (2018).

21.6.8 Open Access and Common Land

97. Under the CRoW Act 2000, the public are not restricted to paths, but can freely walk on mapped areas of mountain, moor, heath, downland and registered common land, known as open access land.

98. There are no areas of open access land within the footprint of the onshore project area, however small areas of open access land are found adjacent to the onshore cable route, at Bacton Wood, near Hoveton along the A140 and along the River Wensum.

99. Open access and common land are considered further in Chapter 30 Tourism and Recreation and are therefore not considered further in this chapter.

21.6.9 Anticipated Trends in the Baseline Environment

100. The baseline review of land use and agriculture in section 21.6 shows that the predominant land use in the area of the project is arable or mixed use agricultural, with some areas of improved or semi-improved grassland, mixed deciduous woodland, coniferous plantations, hedgerows and waterbodies.

101. Chapter 22 Onshore Ecology notes that species associated with farmland environments have declined over the short and long term, with farmland birds and butterflies both declining, whilst mammal (bats) numbers increased from 1999-2015, but the increase has levelled out from the period 2010-2015 (Defra, 2017).

102. Soil erosion is expected to occur naturally over time, depending on weather conditions (exacerbated by climate change) and farming practices. With Norfolk aiming to position itself as a world class research base for innovative agricultural technology, driving improvements in water, energy and nutrient supply, it is hoped that food productivity will increase and address the issues and opportunities cited by Norfolk's Rural Development Strategy (resource pressures, the growth of the knowledge economy, climate change, an ageing and wealthier population and advances in industry and communications). The overall aim of the Strategy is to develop the economy whilst strengthening the relationship between rural and urban areas in a sustainable way, promoting green infrastructure and the protection of biodiversity.

103. Consequently, the quality and availability of agricultural land could reasonably be expected to decline over time, with some potential offsets by advances in agricultural innovations and technology.

21.7 Potential Impacts

104. The EIA has been 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.

105. This section outlines potential impacts as a result of the project and their significance, using the assessment methodology described in section 21.4 and Chapter 6 EIA Methodology.

106. 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.

107. As the construction of the onshore project substation could potentially have different impacts in terms of type and magnitude than those of the onshore cable route, where relevant, the magnitude of these are discussed separately under the same impact, however the greater of the two magnitudes is used to define the significance of that impact overall.

108. Chapter 5 Project Description provides full details of the activities proposed during the construction phase. However, the following activities have the potential to impact land use and agriculture under Scenario 1:

- Cable pulling activities on the onshore cable route that require establishing jointing pit locations and pulling cables through pre-installed ducts including re-use of excavated soil in jointing pits;
- Reinstatement of access tracks and running track to facilitate cable pulling;
- HDD at landfall including construction of transition pit;
- Construction of the onshore project substation, with associated infrastructure and landscaping; and
- Construction of the Necton National Grid substation with infrastructure and landscaping.

109. Under Scenario 2 the following activities which could have the potential to impact land use and agriculture are:

- Pre-construction works along the onshore cable route including modification to existing drainage systems, road modifications, hedge and tree removal, ecological preparation and archaeological surveys;
- Construction of temporary mobilisation areas to support duct installation;
- Construction of temporary works areas to support trenchless crossings;
- Excavation and installation of ducts including establishment of a running track and stockpiling of topsoil and subsoil within the cable route along with the subsequent disposal of excess topsoil or subsoil offsite to a suitable licence facility;
- Temporary upgrade of access tracks and construction of new access tracks; as required;
- Cable pulling activities on the onshore cable route that require establishing jointing pit locations and pulling cables through pre-installed ducts including re-use of excavated soil in jointing pits;
- HDD at Landfall including installation of transition pit;
- Construction of onshore project substation, with associated infrastructure and landscaping;
- Construction of the Necton National Grid substation extension, with infrastructure and landscaping; and
- Overhead line modifications at the Necton National Grid substation.

110. Chapter 5 Project Description provides details of the operation of the project. Impacts may also occur as a result of the presence and operation of the permanent above ground infrastructure (onshore project substation and National Grid substation extension).

21.7.1 Embedded Mitigation

111. Norfolk Boreas Limited has committed to a number of techniques and engineering designs/modifications that are included as an inherent part of the project. These

embedded mitigation measures are intended to avoid or reduce impacts as far as possible.

112. 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 and Chapter 5 Project Description) including engineering preference, feedback from community and landowners, ongoing discussions with stakeholders and regulators, commercial considerations and environmental best practice.

113. The following sections outline the key embedded mitigation measures relevant for this assessment. These measures are presented in Table 21.14.

114. Where embedded mitigation measures have been developed into the design of the project with specific regard to land use and agriculture, these are described in Table 21.15. The impact assessments presented in sections 21.7.4 to 21.7.6 take into account this embedded mitigation.

Table 21.14 Embedded mitigation

Parameter	Mitigation measures embedded into the project design	Notes
Project Wide		
Commitment to HVDC technology	Commitment to HVDC technology minimises environmental impacts through the following design considerations; • HVDC requires fewer cables than the HVAC solution. During the duct installation phase under Scenario 2 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 pits 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.

Parameter	Mitigation measures embedded into the project design	Notes
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 the onshore project substations and National Grid substation extension and associated infrastructure, a preference for the shortest route length (where practical) and developing construction methodologies to minimise potential impacts. Key design principles from the outset were followed (wherever practical) and further refined during the EIA process, including; • 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.	Constraints mapping and sensitive site selection to avoid a number of impacts, or to reduce impacts as far as possible, is a type of primary mitigation and is an inherent aspect of the EIA process. Norfolk Boreas Limited has reviewed consultation received to inform the site selection process (including 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.
Long HDD at Landfall	Use of long HDD at landfall to avoid restrictions or closures to Happisburgh beach and retain access to the beach for the public during construction. Norfolk Boreas Limited	Norfolk Boreas Limited has reviewed consultation received and in response to feedback, has made a number of decisions in relation to

Parameter	Mitigation measures embedded into the project design	Notes
	have also committed to not using the beach car park at Happisburgh South.	the project design. One of those decisions is to use a long HDD at landfall.
Scenario 1		
Strategic approach to delivering Norfolk Boreas and Norfolk Vanguard	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. In accordance with the Horlock Rules, the co-location of Norfolk Boreas and Norfolk Vanguard onshore project substations will keep these developments contained within a localised area and, in so doing, will contain the extent of potential impacts.	The strategic approach to delivering Norfolk Boreas and Norfolk Vanguard has been a project commitment from the outset of each project.
Scenario 2		
Duct installation strategy	The onshore cable duct installation strategy is proposed to be conducted in a sectionalised approach in order to minimise impacts. Construction teams would work on a short length (approximately 150m section) and once the cable ducts have been installed, the section would be back filled and the top soil replaced before moving onto the next section. This would minimise the amount of land being worked on at any one time and also minimise overall disruption.	This has been a very early project commitment. Chapter 5 Project Description provides a detailed description of the process.

Parameter	Mitigation measures embedded into the project design	Notes
Trenchless crossings	Commitment to trenchless crossing techniques to minimise impacts to the following specific features; • 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; • 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 21.15 Embedded mitigation for land use and agriculture

Parameter	Mitigation measures for land use and agriculture	Notes
Agriculture	Land take has been minimised where possible, reducing sterile land parcels, aligning with field boundaries and avoiding the BMV land.	n/a
Drainage	An attenuation pond at the onshore project substation and National Grid substation extension will accommodate additional impermeable ground. Sufficient cable burial depth to minimise impact and interaction with drainage.	Flood risk is considered further in Chapter 20 Water Resources and Flood Risk.

21.7.2 Monitoring

115. Post-consent, the final detailed design of the project and the development of the Code of Construction Practice (CoCP) (DCO Requirement 20) will refine the worst-case impacts assessed in this EIA. It is recognised that monitoring is an important element in the management and verification of the actual project impacts. The requirement for and appropriate design and scope of monitoring will be agreed with the relevant stakeholders and included within the CoCP (DCO Requirement 20) commitments prior to construction commencing.

21.7.3 Worst Case

116. Chapter 5 Project Description details the parameters of the project using the Rochdale Envelope approach. This section identifies those parameters during construction, operation and decommissioning relevant to potential impacts on land use and agriculture.

117. The worst case assumptions with regard to land use and agriculture are presented in a table for each scenario. Table 21.16, summarises the worst case assumptions for land use and agriculture under Scenario 1 and Table 21.17 summarises the worst case assumptions under Scenario 2.

Table 21.16 Worst Case Assumptions for Scenario 1

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Landfall			
Construction	Method	Trenchless technique (e.g. HDD)	Horizontal Directional Drilling (HDD).
	HDD horizontal length (m)	1,000m	Indicative length
	Maximum no. of drills	3	Maximum considers allowance for a failed drilling attempt.
	Maximum drill diameter	750mm	
	Indicative target depth of drill	Up to 20m	Depth relative to mean sea level.
	Maximum temporary works duration	20 weeks	Based on 7am-7pm normal working hours. 7 Days a week.
	Excavated Material	1,325m^3	Excavated material based on maximum drill dimensions (1000m by 750mm) and 3 no. of drills.
Landfall compounds	Maximum number and maximum land take for temporary landfall compounds	6,000m^2	Assumes two compounds at 3,000m^2 (50m x 60m) (total *0.6ha.)* to support parallel drilling rigs.
	Landfall transition pits maximum footprint	1,500m^2	Two pits in total, one pit required per circuit. 10m x 15m (*0.15ha)* x 5m deep.

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Onshore cable route			
Construction (Cable Pulling only)	Cable pull maximum footprint	85,500m^2	Cable pull footprint includes the running track and jointing pits (*8.55ha).*
	Running track width and length	6m and 12,000m	Up to 20% of the running track utilised by Norfolk Vanguard will need to be reinstalled to facilitate cable pulling
	Running track excavated depth	300mm	
	Excavated material for running track	21,600m^3	Volume based on worst case assumption of reinstallation of 12km length of the running track, with a width of 6m and a depth of 0.3m
Permanent jointing pits	Total land take, maximum number and required dimensions	13,500m^2 (Assumes 150 at 90m^2 and 2m deep each)	Dimensions 6m (w) x 15m (l) (*1.35ha).* Spaced approximately one per circuit per 800m cable.
Permanent link boxes	Maximum number and required dimensions	Assumes 24 at 1.5m x 1.5m if below ground and 1.2m x 0.8m x 1.8m if above ground	1 link box per circuit typically be placed at 5.0 km intervals. Type of link box and exact locations to be defined during detailed design. Above ground boxes typically sited on a 0.15m deep concrete slab.
Cable logistics area	Maximum number and required dimensions	Assumes one compound with an area of 4,190m^2	A cable logistics area has been identified for the storage of materials, welfare facilities, etc.
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 all temporary works area at the onshore project substation	95,000m^2	Operational area for substation 250m x 300m= 75,000m^2 *(7.5ha)* plus additional temporary construction compound 20,000m^2 *(2ha).*
	Temporary construction compound for onshore project substation	20,000m^2	Indicative compound 100m x 200m (*2ha).*
	Maximum land take for temporary works area at Spicers Corner	10,000m^2	Spicers Corner compound 100 x 100m (*1ha).*
	Number of HVAC 400kV cables	12	Up to 4 trenches, 3 cables per trench, total of 12 cables
	HVAC 400kV cable route indicative length	1,750m	

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
	Access road construction	6m width and approx. 300m extension length	Extension to the existing access road installed by Norfolk Vanguard from the A47 via the new junction at Spicers Corner.
	Maximum duration	30 months	Indicative construction window 24 months.
Operation	Maximum land take for permanent substation footprint	75,000m^2	The total land requirement for the onshore project substation to the perimeter fence is 250m x 300m (*7.5ha).*
	Maximum land take for new access road	1,800 m^2	Dimensions 300m x 6m *(0.18ha).*
	Operation period	30 years	
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 scenario, impacts as for the construction phase are assumed.		
National Grid extension			
Construction	Maximum land take for temporary works area – substation extension	75,000m^2	150m x 200m adjacent to eastern extension site and compound 300m x 150m adjacent to the Norfolk Vanguard Extension (*total 7.5ha).*
	Maximum duration	30 months	Indicative construction window 24 months.
Operation	Maximum land take for substation extension permanent footprint	20,250m^2	Permanent eastern extension footprint approx. 135m length and 150m wide (*2.03ha).*
	Operation period	30 years	

Table 21.17 Worst Case Assumptions for Scenario 2

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Landfall			
Construction	Method	Trenchless technique (e.g. HDD)	Horizontal Directional Drilling (HDD).
	HDD horizontal length (m)	1,000m	Indicative length
	Maximum no. of drills	3	Maximum considers allowance for a failed drilling attempt.
	Maximum drill diameter	750mm	

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
	Indicative target depth of drill	Up to 20m	Depth relative to mean sea level.
	Maximum temporary works duration	20 weeks	Based on 7am-7pm normal working hours. 7 Days a week.
	Excavated Material	1,325m^3	Excavated material based on maximum drill dimensions (1000m by 750mm) and 3 no. of drills.
Landfall compounds	Maximum number and maximum land take for temporary landfall compounds	6,000m^2	Assumes two compounds at 3,000m^2 (50m x 60m) (total *0.6ha)* to support parallel drilling rigs.
	Landfall transition pits maximum footprint	1,500m^2	Two pits in total, one pit required per circuit. 10m x 15m (*0.15ha*) x 5m deep.
Onshore cable route			
Construction	Method	Open cut trenching and trenchless crossing methods	Trenchless crossing methods (HDD, micro tunnelling or auger boring).
	Maximum working width and length of cable route	35m and 60km	
	Onshore cable route maximum footprint	2,100,000m^2	60km length of cable route x 35m working width (*210ha).*
	Trench excavated material	180,000m^3	
	Gaps at hedgerow / other crossing points	13m	Assumes perpendicular crossing, angled crossing up to 16.5m
	Hedgerows to be removed[9]	165	
	Running track width and length Running track excavated material	6m and 60km 108,000m^3	Volume based on worst case assumption of installation of 60km length of the running track, with a width of 6m and a depth of 0.3m
Mobilisation areas	Maximum number and required dimensions	Assumes 14 at 10,000m^2	Dimensions 100m x 100m. 14 including area at Spicers Corner to be used for substation (*total 14ha).*

[9] 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 to be removed will be determined during surveys of the unsurveyed areas post-consent when access becomes available.

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
Trenchless crossing areas (e.g. HDD)	Trenchless reception sites. Maximum number and maximum land take	Assumes 16 pairs at 5,000m^2	Up to 100m x 50m if stop end employed (t*otal 8ha).*
	Trenchless launch sites. Maximum number and maximum land take	Assumes 16 pairs at 7,500m^2	Up to 150m x 50m if stop end employed (*total 12ha).*
Cable pulling	Cable pulling maximum footprint	85,500m^2	Cable pull footprint includes the running track and jointing pits (*8.55ha).*
Permanent jointing pits	Maximum number and required dimensions	Assumes 150 at 90m^2 and 2m deep each	Dimensions 6m (w) x 15m (l). Spaced approximately one per circuit per 800m cable (total *1.35ha).*
Permanent link boxes	Maximum number and required dimensions	Assumes 24 at 1.5m x 1.5m if below ground and 1.2m x 0.8m x 1.8m if above ground	1 link box per circuit typically be placed at 5.0 km intervals. Type of link box and exact locations to be defined during detailed design. Above ground boxes typically sited on a 0.15m deep concrete slab.
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 all temporary works area at the onshore project substation	95,000m^2	Operational area for substation 250m x 300m= 75,000m^2 plus additional temporary construction compound 20,000m^2 (*total 9.5ha).*
	Temporary construction compound for onshore project substation	20,000m^2	Indicative compound 100m x 200m (*2ha).*
	Maximum duration	30 months	Indicative construction window 24 months.
	Construction Access road from A47	6m width and approx. 1.8m length	Installation of new access road from A47, including junction improvements.
Operation	Maximum land take for permanent footprint.	75,000m^2	Operational footprint 250m x 300m (*7.5ha).*
	Maximum land take for access road.	10,800m^2	Dimensions 1.8km x 6m (*1.08ha).*
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 scenario, impacts as for the construction phase are assumed.		

Worst case assumptions Parameter	Worst case criteria	Worst case definition	Notes
National Grid extension and overhead line modifications			
Construction	Maximum land take for temporary works area – substation extension	67,500m^2	Areas 300m x 150m and 150m x 150m (total *6.75ha).*
	Maximum land take for temporary works area – overhead line	176,310m^2	*17.6ha.*
	Maximum duration	30 months	Indicative construction window 24 months.
Operation	Maximum land take for substation extension permanent footprint	30,000m^2	Permanent western extension footprint approx. 200m length and 150m wide (*3 ha).*
	Maximum land take for overhead line permanent footprint	Up to 1,000m^2	Two new permanent overhead line towers will be required (*0.1ha).*

118. Chapter 5 Project Description outlines the timings to be assessed in relation to the phasing of the construction works. In all cases for land use and agriculture; 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 receptors will be potentially impacted by the project.

21.7.4 Potential Impacts during Construction

21.7.4.1 Impact 1: Drainage

119. Groundworks associated with the construction of the onshore cable route and onshore project substation (including the National Grid substation extension) have the potential to cause an adverse impact to the natural and artificial field drainage systems during construction works. Existing field drains are considered likely to be at varying depths between 0.5m – 1.5m, and are expected to be made of ceramic, plaster or other materials. Field drains would be expected to be impacted by any excavation works planned through agricultural fields. It will be necessary to truncate the drainage systems temporarily during duct installation and during the excavation of the jointing pits and transition pits (if required); these will then be fully reinstated following construction. More information regarding the local drainage network is provided in Chapter 20 Water Resources and Flood Risk.

21.7.4.1.1 Scenario 2

Landfall and onshore cable route

120. Under Scenario 2 the excavation of the cable trench for duct installation and the stockpiling of soils has the potential to cause an adverse impact to the natural and artificial field drainage systems during construction. Soil types found along the onshore cable route and at the landfall are mostly freely draining acidic, loamy soils, however due to the presence of field drainage networks, some of which are unmapped and informal, the receptor is considered to have a medium sensitivity. This is due to them having a limited capacity to accommodate changes such as degradation or poor reinstatement (see Table 21.5).

121. At the landfall the maximum temporary works duration is 20 weeks, including the construction of the two transition pits. On the cable route land drains will potentially be disrupted during the duct installation phase in a single two year operation; during this, work sections are expected to be roughly 150m in length, with each work section taking approximately one to two weeks to complete including instating temporary drainage measures. Following duct installation, the maximum construction window for the jointing pits will mean a disturbance to any one area for a maximum of 10 weeks in any one year during the two year cable pulling phase.

122. Without mitigation, the magnitude of the effect is considered to be low, due to the short term (less than five year) loss of soil and associated drainage.

Onshore project substation (including the National Grid substation extension and overhead line modification)

123. At the onshore project substation and National Grid substation extension including overhead line modifications, any existing field drainage would be taken out of use during construction. The soil at the onshore project substation is considered to be primarily loamy and clayey with impeded drainage and therefore have a limited capacity to accommodate changes. This is therefore categorised as having medium sensitivity.

124. Land drains will only potentially be disrupted during the installation of the onshore project substation earthworks and National Grid overhead line modifications in a single two-year operation. Therefore without mitigation, the magnitude of effect is considered to be low, due to >20ha of soil and associated drainage being temporarily unsuitable in the short term (less than five years) for agriculture.

Impact significance

125. Without mitigation, the greatest effect arising from the project on drainage is of low magnitude due to the scale and timing of the works (short term loss of >20ha), on a medium sensitivity receptor, resulting in an impact of **minor adverse** significance.

126. Best practice mitigation measures are proposed to further reduce impacts and include maintaining/reinstating land drainage systems following construction, the provision of an Agricultural Liaison Officer (ALO) and a local specialised drainage contractor (to undertake surveys and create drawings pre- and post-construction, to locate drains and ensure appropriate reinstatement), the implementation of the final CoCP and SMP which would include provisions for a pre-construction Drainage Plan to minimise water within the trench and ensure ongoing drainage of surrounding land, in order to avoid any material change to the soil resource and reduce the magnitude of the effect to negligible. The SMP would include construction method statements for soil handling, would be produced by a competent soil science contractor and agreed with the relevant stakeholder, in advance of the works. This would be completed pre-construction once an earthworks contractor has been appointed and detailed earthworks phasing information is available. The contractor would be required to comply with the SMP, included within the CoCP (DCO Requirement 20).

127. Best practice soil handling would be implemented during the pre-construction and construction phases to prevent the spread of plant and animal diseases, including following the Environment Agency (EA) (2010) guidance: Managing Invasive Non-native Plants.

128. Measures contained in relevant Defra and EA best practice guidance on the control and removal of invasive weed species would be implemented during the pre-construction and construction phases. A pre-construction land survey would be undertaken by a qualified ALO to record details of crop regimes, position and condition of field boundaries, existing drainage and access arrangements, and private water supplies.

129. Land would be reinstated to its pre-construction condition as soon as reasonably possible following duct installation (and subsequently in isolated sections for cable pulling), dependent on weather conditions and excluding permanent infrastructure (onshore project substation, link box locations and National Grid substation extension and overhead line modification).

130. At locations where the onshore cable route crosses existing drains, the running track would be installed over a pre-installed culvert pipe or other temporary bridging to allow continued access to the onshore cable route during construction. The pipe would be installed in the drain bed so as to avoid upstream impoundment and would be sized to accommodate reasonable 'worst-case' water volumes and flows.

131. Where drains are shallower than 1.5m, temporary damming, culverting or diverting may be employed, with agreement from relevant internal drainage boards and flood management agencies.

132. The cable circuits would nominally be installed in a flat formation (each cable core installed alongside each other) to a minimum depth of 1.05m (see Plate 5.17 in Chapter 5), in a trench of approximate 1m width. This depth would allow the cables (and protective tiles and tape) to be laid below the level of typical field drainage pipes and other underground services to minimise impact and interaction.

133. The mitigation measures would be dependent upon the field by field characteristics of soils, weather conditions, existing drainage arrangements and crops grown. Land drainage reinstatement techniques are well established and are often required periodically within agricultural land as part of general maintenance requirements.

134. This additional proposed mitigation is expected to reduce the residual impact to **negligible**.

21.7.4.1.2 Scenario 1

Landfall and onshore cable route

135. In Scenario 1, all duct installation and associated enabling works along the onshore cable route would have been completed by Norfolk Vanguard. As such the potential disruption of land drains for the landfall and onshore cable route would be limited to the excavation and stockpiling of soils during the construction of the transition pits at the landfall and the jointing pits along the onshore cable route.

136. The maximum temporary works duration at the landfall is 20 weeks, including the construction of the two transition pits, with a maximum land take of 0.15ha. There will be approximately 150 jointing pits required for cable pulling activities (spaced approximately one per circuit per 800m cable), each jointing pit will cover a maximum footprint of 0.009ha with an estimated total footprint of 1.35ha (see Table 21.16). Land drains will only potentially be disrupted during the jointing pit excavation at any one location for up to a 10 week period.

137. The field drainage networks in this instance are therefore considered to have low sensitivity, as they have a moderate capacity to accommodate changes due to the limited and isolated areas of disturbance at jointing pit locations and due to the transition pits at the landfall (see Table 21.5).

138. Without mitigation, the magnitude of the effect is considered to be low, due to the limited scale and the short term loss of soil and associated drainage (loss of <20ha for less than five years).

Onshore project substation (including the National Grid substation extension)

139. At the onshore project substation and National Grid substation extension, any existing field drainage would be taken out of use during construction. Under Scenario 1 the overhead line works would have been completed by Norfolk

Vanguard therefore limiting the footprint of impacts to the onshore project substation and National Grid substation extension. The soil at the onshore project substation is considered to be primarily loamy and clayey with impeded drainage and therefore have a limited capacity to accommodate changes. This is therefore categorised as having medium sensitivity.

140. Without mitigation, the magnitude of effect is considered to be low, due to <20ha of soil and associated drainage being temporarily unsuitable in the short term (less than five year) for agriculture, as land drains will only potentially be disrupted during the installation of the onshore project substation earthworks in a single two year operation.

Impact significance

141. Without mitigation, the greatest effect arising from the project is of low magnitude due to the scale and timing of the works (short term loss of <20ha), on a medium sensitivity receptor, resulting in an impact of **minor adverse** significance.

142. Best practice mitigation is proposed, as detailed under Scenario 2, including the provision of an ALO and local specialised drainage contractor (to undertake surveys and create drawing pre- and post-construction which will have been done prior to the duct installation works), the implementation of a CoCP and SMP (DCO Requirement 20) and adherence to the relevant best practice on soil handling.

143. This additional proposed mitigation is expected to reduce the residual impact to **negligible.**

21.7.4.2 Impact 2: Land taken out of existing use/disruption to agricultural activities

144. Land would either be taken out of existing use or isolated due to construction activities and therefore effectively taken out of use. This would result in loss of a growing season in the area affected for each farmer (plus possible severance) and the loss of associated income, which would be addressed via private agreements.

145. There is also potential for adverse impacts such as compaction to soil structure and future agricultural productivity of soils impacted during construction through the use of heavy machinery and disturbance.

21.7.4.2.1 Scenario 2

Landfall and onshore cable route

146. Table 21.17 shows the total construction land take area based on worst case assumptions. At the landfall this is anticipated to be 0.6ha and along the onshore cable route, the total construction land take under Scenario 2 is anticipated to be 210ha during duct installation and approximately 8.6ha during cable pulling.

147. The area of land that would need to be excluded from landowners, occupiers or the public has been minimised through a comprehensive route selection process as described in Chapter 4 Site Selection and Assessment of Alternatives, through extensive consultation with landowners and through the selection of HVDC technology. Access for farm vehicles to land severed by the construction works would be maintained wherever practicable in consultation and subject to individual agreements with landowners and occupiers. Where necessary, crossing points would be agreed pre-construction to minimise severed areas of land.

148. At this stage it is not possible to calculate the area of land that would become isolated or inaccessible, as access to individual fields would be determined as part of detailed design and construction planning during the post consent period. During construction, it is unavoidable that some accesses may become restricted, however during detailed design, efforts will be made to limit access restriction, and avoid isolating large parcels of land.

149. Based on the information provided in section 21.6, the majority of the construction footprint would be within areas currently associated with agricultural production.

150. Temporary land take would result from works along the onshore cable route (trenching, running track, soil storage) and at jointing pit locations, also at mobilisation areas, as well as the entry and exit pit and temporary compounds associated with HDD at the landfall and trenchless crossing location. Much of which would be agricultural land taken temporarily out of use.

151. The predominant impacts in relation to land take would be during the two years of duct installation for the landfall and onshore cable route.

152. Where possible, reinstatement of hedgerows and their associated features (banks and ditches) and drainage systems to previous conditions as far as reasonably possible would occur following the duct installation phase. Removal of trees or interference with roots would be avoided where possible (for further details see Chapter 22 Onshore Ecology). The exact timing and duration of works at any location are not known at this time.

153. The quality of the land varies from ALC grades 1 – 4, however over 50% of the land area is ALC grade 3, as a precautionary approach this assessment is assuming all grade 3 land is grade 3a as a worst case. Therefore, the sensitivity of the receptor, in accordance with Table 21.5, is considered to be high. Based on the length of construction and the temporary nature of the effect (less than five years), with only temporary restriction to agricultural activities; the magnitude of effect is considered to be medium.

154. During construction it is unavoidable that land along the onshore cable route would temporarily be taken out of its existing land use, however the embedded mitigation measures (Table 21.14) reduce the potential impacts as far as practicable. Loss of ecological features such as hedgerows and trees are assessed in Chapter 22 Onshore Ecology, and mitigation proposed where necessary.

Onshore project substation

155. The onshore project substation works will lead to at most a temporary loss of approximately 11.6ha of arable land for the duration of the construction phase (worst case 30 months).

156. The sensitivity of the receptor is considered to be high, as the onshore project substation is proposed on ALC grade 3 land, assumed as a precautionary approach to be ALC grade 3a as a worst case, which is considered to be of high sensitivity. The magnitude of effect is considered to be low, based on the scale and length of construction with temporary restriction to agricultural activities.

National Grid substation extension and overhead line modifications

157. Work at the National Grid substation extension including works required for overhead line modifications will result in a temporary loss of approximately 27.4ha of arable land for the duration of the construction phase (approximately 30 months).

158. The sensitivity of the receptor is considered to be high, because the quality of the land is ALC grade 2. The magnitude of effect is considered to be low based on the scale and length of construction with temporary restriction to agricultural activities.

Impact significance

159. Without mitigation, the greatest effect arising from the project is a medium magnitude, on a high sensitivity receptor, resulting in an impact of **major adverse** significance.

160. Mitigation is proposed. Potentially affected landowners have been consulted on as part of the project, and there will be ongoing consultation as required through the post-consent and detailed design phase, prior to construction.

161. Access for farm vehicles to land severed by the works would be maintained wherever practicable in consultation and subject to individual agreements with landowners and occupiers. Where necessary, crossing points would be agreed pre-construction.

162. Wherever practicable, appropriate planning and timing of works will be agreed with landowners and occupiers, subject to individual agreements, to reduce conflicts.

163. Private agreements (or compensation in line with the compulsory purchase compensation code) will be sought between Norfolk Boreas Limited and relevant

landowners/occupiers regarding any measures required in relation to crop loss incurred as a direct consequence of the construction phase of the project. It is expected that these mitigation measures will reduce the predicted residual impact to **minor adverse**, as the risk associated with loss of land for agriculture and its associated usability and value will be reduced to a negligible magnitude.

21.7.4.2.2 Scenario 1

Landfall and onshore cable route

164. Under Scenario 1 the potential impacts associated with land either being taken out of existing use or isolated, or impacts on soil productivity on the cable route is limited to the works associated with the cable pulling phase as all cable duct installation works would have been completed by Norfolk Vanguard. This is significantly less than that outlined in Scenario 2, and therefore disruption to agricultural activities will be of a much lesser extent.

165. Temporary land take would result from the footprint of the jointing pit locations, reinstatement of the running track and the temporary compounds associated with HDD at the landfall; much of which would be agricultural land taken temporarily out of use.

166. Table 21.16 outlines the total construction land take area based on worst case assumptions associated with the landfall and cable pulling. At the landfall this is anticipated to be 0.6ha and 8.6ha for the cable pulling activities (this includes running track and jointing pits).

167. The predominant impacts in relation to land take would be the same as that outlined under Scenario 2, however the extent of the land take is significantly less along the cable route (210ha in Scenario 2 and 8.6ha in Scenario 1) and occurs at isolated locations during the two years of cable installation.

168. The sensitivity of the receptor is considered to be high, as detailed for Scenario 2 above. The magnitude of effect is considered to be negligible, based on the limited duration of the works and the temporary nature of the effect, with only temporary restrictions to agricultural activities at isolated locations.

Onshore project substation

169. The impacts associated with land take at the project substation are the same as those outlined under Scenario 2, with a marginally smaller area affected (approximately 10.5ha) due to the access road having already been installed by Norfolk Vanguard.

170. The sensitivity of the receptor is considered to be high, because the quality of the land is ALC grade 3 and therefore is being considered in this assessment as a

precautionary approach to have the potential of being ALC grade 3a and therefore of high sensitivity (Table 21.4). The magnitude of effect is considered to be low, based on the length of construction with temporary restriction to agricultural activities.

National Grid substation extension

171. Under Scenario 1 the overhead line modifications would have been completed by Norfolk Vanguard, significantly reducing the total temporary works footprint. The National Grid substation extension will be in an easterly direction and will result in a temporary loss of approximately 9.5ha of arable land for the duration of the construction phase (approximately 30 months).

172. The sensitivity of the receptor is considered to be high, because the quality of the land varies from ALC grades 2 – 3. The magnitude of effect is considered to be low, based on the length of construction with temporary restriction to agricultural activities.

Impact significance

173. Without mitigation, the greatest effect arising from the project is a low magnitude, on a high sensitivity receptor, resulting in an impact of **moderate adverse** significance.

174. Mitigation is proposed and will be the same as outlined for Scenario 2. It is expected that these mitigation measures will reduce the predicted residual impact to **minor adverse**, as the risk associated with loss of land for agriculture and its associated usability and value will be reduced to a low magnitude.

21.7.4.3 Impact 3: Degradation of natural resources – soil

175. There is the potential for soils to be compacted and soil structure to deteriorate during the works, especially along access routes, running tracks and where heavy materials or equipment will be stored, as well as due to changes to the local drainage (this is assessed in Chapter 20 Water Resources and Flood Risk). The result would be reduced biological activity, porosity and permeability and increased strength. It can also lead to reduced water infiltration capacity and increased risk of erosion (European Commission, 2008). The potential effects of these impacts are reduced fertility and crop yields, should the site be returned to agricultural use in the future.

176. If soils are not stored or reinstated correctly, or are compacted, there is potential to lose the definition of soil profiles, which can lead to homogenisation of the soil. Again, this may reduce fertility and crop yields if the soils are returned to agricultural use in the future. As well as the physical changes to the soil resource, there is also the potential to impact on the chemical, pH and organic content in soils.

177. Disturbance of soils may result in a loss of carbon, previously sequestered in the soil, to the atmosphere as a result of processes including microbial action. Carbon may be lost from soil as a result of physical disturbance (including disturbance during agricultural activities such as ploughing) which breaks up soil aggregates and enhances oxygenation. It can also be lost due to construction activities, for example losses from the core of stockpiled soils through microbial decomposition. Land drainage or stockpiling can result in drying and decomposition of peaty layers. Spills and leaks of contaminative materials during construction can also adversely affect the soil quality.

21.7.4.3.1 Scenario 2

178. Under Scenario 2 the following activities proposed during the onshore construction works have been identified as having the potential to degrade the existing soil resource:

- Intrusive pre-construction technical and environmental surveys;
- Removal of trees and vegetation;
- Topsoil stripping, earthworks and landscaping within the construction footprint;
- Construction and operation of the running track;
- Operation of the mobilisation areas;
- Storage of topsoil and subsoil; and
- Reinstatement of subsoil and topsoil.

179. The soils in the onshore project area are in general loamy and clayey and, therefore susceptible to compaction. They are also difficult to handle during wet periods using machinery without causing structural degradation. Given these characteristics, the soil resource at the site is conservatively considered to be of high sensitivity with respect to potential for degradation during the construction period.

Impact significance

180. Norfolk Boreas Limited have sought to minimise the use or impact on natural resources as a result of the project. Impacts on the soil resource have been minimised through the sensitive siting of the landfall, onshore cable route and onshore project substation (avoiding where possible land take of the BMV soil and land under ESS), and through the selection of the HVDC technology, minimising the project footprint and thereby minimising the use of natural resources.

181. Embedded mitigation measures as outlined in Table 21.14 would avoid any material change to the soil resource and aid in the recovery of the land. It is therefore considered that the sensitivity of the receptor is low (some resistance to structural damage), and the magnitude of the effect is also considered to be low.

182. Without additional mitigation, the greatest effect arising from the project is low magnitude, on a low sensitivity receptor, resulting in an impact of **minor adverse** significance.

183. A range of best practice measures are proposed to further reduce the effect of the construction activities on the soil resource. These include:

- Soils handling, storage and reinstatement by a competent contractor under Defra (2009) Construction code of practice for the Sustainable Use of Soils on Construction Sites;
- Topsoil stripping within all construction areas and storage adjacent to where it is extracted, where practical;
- Storage of the excavated subsoil separately from the topsoil, with sufficient separation to ensure segregation;
- Handling of soils according to their characteristics e.g. within wooded areas it is unlikely that topsoil resources of any quality could be separated and preserved for reuse. If current wooded areas are to be used for storage it would not be necessary to undertake topsoil stripping;
- Where necessary, tree roots would be removed by screening;
- Where under storage areas, loosening of subsoils is proposed when dry to improve permeability before the topsoil is replaced;
- For most after-uses, subsoils may be treated as a single resource for stockpiling;
- During wet periods, limiting mechanised soil handling in areas where soils are highly vulnerable to compaction;
- Restricting movements of heavy plant and vehicles to specific routes and avoidance of trafficking of construction vehicles in areas of the site which are not subject to construction phase earthworks;
- Minimising the excavation footprint where possible; and
- In circumstances where construction has resulted in soil compaction, further remediation may be provided, through an agreed remediation strategy.

184. These measures outlined above would be set out in a SMP, including construction method statements for soil handling, which would be produced by a competent soil science contractor and agreed with the relevant stakeholder in advance of the works. This would be completed pre-construction once an earthworks contractor has been appointed and detailed earthworks phasing information is available. The contractor would be required to comply with the SMP.

185. Private agreements (or compensation in line with the compulsory purchase compensation code) will be sought between Norfolk Boreas Limited and relevant landowners/occupiers regarding any measures required in relation to crop loss incurred as an indirect consequence of degradation of the soil resource during the

construction phase of the project. This is expected to reduce the residual impact to **negligible**.

21.7.4.3.2 Scenario 1

186. Under Scenario 1 the activities proposed during the construction phase which have been identified as having the potential to degrade the existing soil resource are limited to:

- Intrusive pre-construction technical and environmental surveys;
- Removal of trees and vegetation;
- Topsoil stripping, earthworks and landscaping within the construction footprint;
- Construction and operation of the running track;
- Storage of topsoil and subsoil; and
- Reinstatement of subsoil and topsoil.

187. These activities would be confined to those associated with the landfall, the jointing pit locations and construction of the onshore project substation and National Grid substation extension. As such the footprint under Scenario 1 (approximately 30ha) would be significantly less than under Scenario 2 (approximately 250ha) therefore the magnitude of the impact is considered negligible.

Impact significance

188. As detailed in Scenario 2 the embedded mitigation measures outlined in Table 21.14 and the application of best practice measures would avoid any material change to the soil resource and aid in the recovery of the land, therefore the sensitivity of the receptor is considered to be low (some resistance to structural damage) and the magnitude of the effect is considered to be negligible, resulting in a **negligible** impact.

21.7.4.4 Impact 4: Loss of soil resource – erosion

21.7.4.4.1 Scenario 2

189. In certain weather conditions, some soil types can be susceptible to erosion during excavation, storage or following reinstatement. Given the relatively cohesive nature of the soil resource identified within the construction footprint (clayey loams), it is considered that the soils would be not be vulnerable to this effect and the sensitivity of the soils to erosion is considered to be low.

190. The project requires excavation activities to take place during the construction of the onshore cable route, landfall and onshore project substation and the National Grid substation extension (an overall footprint of approximately 250ha). The potential magnitude of the effect is, predicted to be medium, due to the medium to long term

(two to greater than five years) loss of > 20ha of the BMV agricultural land (ALC grades 1 to 3).

Impact significance

191. Prior to additional mitigation, the greatest magnitude arising from the project is medium, on a low sensitivity receptor, resulting in an impact of **minor adverse** significance.

192. Best practise measures are therefore proposed to reduce any effects from loss of soil resource by erosion include adherence to the MAFF (2000) Good Practice Guide for Handling Soils and Defra (2009) Construction code of practice for the Sustainable Use of Soils on Construction Sites. These recommend:

- Only working in appropriate weather conditions where soil type dictates;
- Appropriate soil storage;
- Maintaining effective drainage systems during construction; and
- Ensuring reinstatement of individual areas occurs as soon as practicable after construction and planting vegetation shortly afterwards.

193. These measures would be captured in a SMP that the contractor would be required to comply with, which will employ best practice techniques to protect the soil resource.

194. A commitment will be made within the private agreements between Norfolk Boreas Limited and the landowner/occupier to compensate for crop loss incurred as an indirect consequence of soil erosion during the construction phase of the project. It is expected that this will reduce the predicted residual impact to **negligible**, as the risk associated with loss of soil resource will be reduced to a negligible magnitude.

21.7.4.4.2 Scenario 1

195. Under Scenario 1, the project requires excavation activities during the construction of the jointing pits during cable pulling, landfall and onshore project substation and the National Grid substation extension (an overall footprint of approximately 30ha). As the overall excavation footprint required for the onshore cable route under Scenario 1 is significantly less than that required under Scenario 2. As such, the potential magnitude of effect is predicted to be low, due to the scale of the works.

196. As detailed in Scenario 2 given the relatively cohesive nature of the soil resource identified within the construction footprint (clayey loams) the sensitivity of the soils to erosion is considered to be low.

Impact significance

197. The greatest effect arising from the project is of a low magnitude, on a low sensitivity receptor, resulting in an impact of **minor adverse** significance.

198. Best practise measures are proposed, as outlined under Scenario 2, which is expected to reduce the residual impact to **negligible**.

21.7.4.5 Impact 5: ESSs

199. During the construction period, there would be the potential for impacts on the ESS within the onshore project area. The effect on individual landowners / occupiers is likely to be specific to their own scheme, which would need to be discussed between Norfolk Boreas Limited, landowners, occupiers and Natural England prior to construction. The impacts could range from the agreement ceasing entirely to no impact on the agreement, depending on the agreement objectives and location of the works. As such, this assessment looks at the impacts in general terms rather than on an agreement by agreement basis. Two potential connected impacts are anticipated as a result of construction works under both scenarios:

- Ecological – in terms of the loss of the agreements and the substantive agri-environmental objectives of the scheme; and
- Financial – in terms of the loss of the agreements and the impact on overall farming income (this would be addressed via private agreements).

200. Following the completion of construction, all areas subject to ESS would be reinstated (see Chapter 22 Onshore Ecology) and it is likely that the same or similar agreements would be reinstated following construction; under Scenario 1 however there is a small (3.2ha) area of ESS land that will be permanently take out of use due to the presence of the onshore project substation and associated mitigation planting (section 21.7.5.5).

201. The National Grid substation extension areas do not include any ESS and therefore **no impact** is predicted under either scenario.

21.7.4.5.1 Scenario 2

Landfall and onshore cable route

202. During construction, there would be the potential for impacts from the onshore cable route on ESS, as described above.

203. Ecological features that are likely to be subject to agreements, such as trees and ponds, have been avoided where practicable. A number of rivers, ditches and hedgerows would be crossed; however, these would be crossed at right angles where possible/practicable to minimise disturbance to those features, and replanted / reinstated following completion of the works. A number of sensitive features such as certain rivers will be crossed using trenchless techniques (e.g. HDD) to minimise impacts (see Chapter 20 Water Resource and Flood Risk).

204. The onshore cable route crosses Entry Level (1.26ha, 0.23% of onshore project area) and Entry Level plus Higher Level (117.6ha, 21.4% of onshore project area) Stewardship Scheme agreements.

205. There is potential for a certain amount of disruption to ESS as a direct result of loss of land during the construction affecting such features as field margins. A number of landowners within an ESS would be affected by the project. The total land with an ESS agreement crossed by the landfall and onshore cable route is 0.08% of ESS in Norfolk as a whole. It is considered that the overall magnitude of effect would be negligible at a county scale, due to the area affected, the extent of agreements within the onshore cable route, and the nature of the ESS. The sensitivity of receptors is considered to be medium, as the ESS effected are Entry level and Entry Level plus Higher Level (see Table 21.5).

Onshore project substation

206. Under scenario 2, there a small piece of ESS land within the red line boundary at the onshore project substation of Entry Level plus Higher Level (a total of 3.2ha), however there is no construction expected to occur on this area of land and it is therefore considered that there will be **no impact** on ESS at the onshore project substation.

Impact significance

207. Prior to mitigation, the greatest effect arising from the project is of negligible magnitude, on a medium sensitivity receptor, resulting in an impact of **minor adverse** significance.

208. A commitment will be made within the private agreements between Norfolk Boreas Limited and the landowner/occupier to compensate for losses incurred due to potential impacts on ESS during the construction phase of the project. This is expected to reduce the predicted impact to **negligible**.

21.7.4.5.2 Scenario 1

Landfall and onshore cable route

209. Despite the disruption to the land along the cable route being of a much smaller scale than under Scenario 2; limited to excavation of the jointing pits and reinstatement of running track sections, these activities have the potential to be constructed on areas of land subject to ESS. As outlined under the assessment for Scenario 2; the disruption of ecological features that are likely to be subject to agreements, such as trees and ponds, have been avoided where practicable. It is considered that the overall magnitude of effect would be negligible at a county scale, due to the area affected, the extent of agreements within the onshore cable route, and the nature of the ESS.

Onshore project substation

210. There is potential for disruption to a small piece of ESS land Entry Level plus Higher Level (up to 3.2ha) during the construction of the onshore project substation. The effect this may have on the individual landowners / occupier would be discussed between Norfolk Boreas Limited, landowners, occupiers and Natural England prior to construction. It is therefore considered that the overall magnitude of effect would be negligible.

Impact significance

211. The impact significance is therefore the same as outlined under Scenario 2 and prior to mitigation, the greatest effect arising from the project is of negligible magnitude, on a medium sensitivity receptor, resulting in an impact of **minor adverse** significance.

212. As detailed under the assessment for each scenario, a commitment will be made within the private agreements between Norfolk Boreas Limited and the landowner/occupier to compensate for losses incurred due to potential impacts on ESS during the construction phase of the project. This is expected to reduce this impact to **negligible**.

21.7.4.6 Impact 6: Utilities

21.7.4.6.1 Scenario 1 and Scenario 2

213. The onshore cable route has been selected to avoid major utilities where possible/practicable. Potentially affected utility providers have been consulted on as part of the project, and there will be ongoing consultation as required through the post-consent and detailed design phase, prior to construction.

214. Norfolk Boreas Limited would undertake utility crossings in accordance with industry standard practice as agreed with the utility owners.

215. The continuity of water supplies during the construction works would be ensured.

216. Therefore, **no impacts** associated with existing utilities are anticipated during construction.

21.7.5 Potential Impacts during Operation

217. This section describes the potential impacts arising during the operational phase of the project. Reference should also be made to Chapter 5 Project Description for full details of the operational phase. The operational impacts are largely the same under Scenario 1 and Scenario 2, with the exception of the location of the National Grid substation extension, therefore where appropriate, this element has been assessed separately.

21.7.5.1 Impact 1: Drainage

218. Land drains are present throughout the onshore project area. The mitigation measures outlined in section 21.7.4.1 would ensure the impact on land drainage is minimised.

219. The potential drainage requirements and strategy for minimising flood risk at the onshore project substation are discussed in Chapter 20 Water Resource and Flood Risk.

220. All drainage would be reinstated and drainage requirements at the onshore project substation would be compliant with the Flood Risk Assessment (FRA) (Chapter 20 Water Resources and Flood Risk Appendix 20.1 FRA).

221. Due to the reinstatement of all drainage post construction and adherence with the FRA, **no impact** is predicted during operation.

21.7.5.2 Impact 2: Permanent change to land use

21.7.5.2.1 Landfall and onshore cable route

222. A permanent easement has been sought by Norfolk Boreas Limited directly over the cables. The easement would restrict activities which would penetrate the ground by more than 0.65m. As such, it is expected that normal agricultural activities would be able to continue.

223. The areas of land that would be affected by permanent easement restrictions have been minimised through the robust route selection process as described in Chapter 4 Site Selection and Assessment of Alternatives.

224. Discussions with landowners regarding potential future land uses and any restrictions on these (for example there may be restrictions on construction or planting e.g. trees or hedgerows on or within a certain distance from the onshore cable easement) would be undertaken as part of ongoing discussions between landowners and Norfolk Boreas Limited.

225. In terms of potential impacts to the root growth zone, any impacts would be highly localised, immediately surrounding the cables / ducts themselves. If required, a rapid reconnaissance at selected locations along the route could be undertaken post construction. Visual indicators of poor crop performance (relative to surrounding areas outside the onshore cable route) can be used to assess potential damage which may then be investigated in further detail. Should potential issues be raised, these would be investigated and remediation strategies agreed and implemented where appropriate. Continuous monitoring would then be employed where necessary.

226. Routine maintenance is anticipated to consist of one annual visit to each link box (approximately every 5 km) to carry out routine integrity tests, which would be accessed via the cabinets or by the manhole covers. Appropriate off-road vehicles would be used to access each link box, and link boxes would be located adjacent to field boundaries or roads as far as possible.

227. Non-scheduled maintenance/repairs to address faults as and when these may arise would also be necessary, and this maintenance/repair could be required anywhere along the onshore cable route. It is anticipated that non-scheduled maintenance events would be highly localised, temporary and of short duration.

228. The sensitivity of the receptor is considered to be high; whilst the quality of the land varies from ALC grades 1 – 4, 50% of the land area is ALC grade 3 and as discussed within Table 21.4, for precautionary means this assessment is assuming that all grade 3 land is grade 3a as a worst case. The magnitude of effect is considered to be negligible due to the small area of land affected and the temporary nature of the impact (i.e. only when access is required).

21.7.5.2.2 Onshore project substation

229. The total permanent land take for the footprint of the onshore project substation is approximately 7.5ha and less than 1 hectare for the access road. Additional land is also required for planting/screening, as detailed in Chapter 29 Landscape and Visual Impact Assessment. The onshore project substation is proposed on land classified as ALC grade 3, which, as previously discussed is, for the means of this assessment, assumed to constitute grade 3a and is therefore considered to be of high sensitivity. The land would be taken out of use permanently. Whilst the onshore project substation at a local, field boundary level is a large size, in the context of the county resource and the potential impacts to agricultural productivity (as outlined above in section 21.6.3), the magnitude is considered to be low.

21.7.5.2.3 National Grid substation extension

230. Total permanent land take to accommodate works in the National Grid substation extension is approximately 3.1ha under Scenario 2 (including overhead line modifications) and 2.03ha under Scenario 1. Additional land is required for planting and screening as detailed in Chapter 29 Landscape and Visual Impact Assessment. The National Grid substation extension is proposed in ALC grade 2 land, and therefore is considered to be of high sensitivity. The land would be taken out of use permanently. Due to the small area of the National Grid substation extension in the context of the regional resource (as outlined above in section 21.6.3), the magnitude is considered to be low.

21.7.5.2.4 Impact significance

231. Embedded mitigation measures have minimised impacts to the BMV land through the site selection process. Prior to additional mitigation, the greatest magnitude of effect arising from one element of the onshore infrastructure is low, as the total land take covered by the onshore project area accounts for 0.1% of county agricultural resource, on a receptor with an at worst high sensitivity. The impact significance is therefore predicted to be **moderate adverse**.

232. Mitigation measures are proposed which include the protection of the soil resource and reinstatement of land to previous conditions will be sought as far as reasonably possible through the CoCP and the SMP. Private agreements will be sought between Norfolk Boreas Limited and relevant landowners/occupiers regarding any permanent loss of land incurred as a direct consequence of the operation phase of the project. Therefore, the residual impact is expected to reduce to **minor adverse**.

21.7.5.3 Impact 3: Degradation of Natural Soil Resource

233. There will be no earthworks during operation, therefore **no impact** is predicted on natural soil resource during operation.

21.7.5.4 Impact 4: Loss of Soil Resource

234. There will be no earthworks during operation, therefore **no impact** is predicted on loss of soil resource during operation.

21.7.5.5 Impact 5: ESSs

21.7.5.5.1 Onshore project substation including National Grid substation extension, and overhead line works

Scenario 2

235. Under scenario 2, despite a small piece of Entry Level plus Higher Level (a total of 3.2ha) ESS land within the red line boundary at the onshore project substation of, there is no construction expected to occur on this area of land. It is therefore considered that there will be **no impact** on ESS at the onshore project substation.

Scenario 1

236. Under scenario 1 there is a small piece of Entry Level plus Higher Level ESS land (up to 3.2ha) that falls within the onshore project area at the onshore project substation, this land will be taken out of use due to the presence of the onshore project substation and associated mitigation planting. The effect this may have on the individual landowners / occupiers would be discussed between Norfolk Boreas Limited, landowners, occupiers and Natural England prior to construction. It is therefore considered that the overall magnitude of effect would be negligible.

21.7.5.5.2 Landfall and onshore cable route (both scenarios)

237. Following construction, it is expected that all land under an ESS within the onshore project area that has been affected would be reinstated. In terms of permanent infrastructure along the onshore cable route and at the landfall, there would be a total of 24 link boxes (2.25m^2 per link box under the worst case assumptions), which could potentially impact on land designated under an ESS. Link boxes would be located adjacent to field boundaries where possible.

238. The sensitivity of receptors is considered to be medium, as the ESS effected are Entry level and Entry Level plus Higher Level (see Table 21.5) and due to the very small scale of the impact the magnitude is considered to be negligible.

239. Potential impacts regarding permanent easement are discussed in permanent changes to land use in section 21.7.5.2.

Impact significance

240. Without mitigation, the magnitude of effect is negligible, on a receptor with a medium sensitivity. The predicted impact is therefore **minor adverse**. No further mitigation is therefore proposed.

21.7.5.6 Impact 6: Utilities

241. The potential exists for repair activities to affect utilities, since these activities may require access to the buried cables. Utilities are considered to be highly sensitive, in particular electricity, gas and water, due to the potential disruption that could be caused should the services be disrupted.

242. As described in section 21.6.7, potentially affected utility providers would be contacted and the location of existing services would be identified prior to maintenance works to ensure there would be **no impact**.

21.7.6 Potential Impacts during Decommissioning

243. This section describes the potential impacts of the decommissioning of the onshore infrastructure with regards to impacts on land use and agriculture. 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.

244. 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.

245. 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.

246. Whilst details regarding the decommissioning of the onshore project substation are currently unknown, considering the worst case scenario 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 during construction.

247. 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.

21.8 Cumulative Impacts

248. Potential cumulative impacts to land could arise from interaction with other developments within the vicinity of the onshore project area, either spatially or temporally. Given that the land use impacts of the project mostly affect receptors within the onshore project area, there is limited potential for interaction with any developments which do not have direct overlap with the project. With regard to land use receptors assessed in this chapter, a potential for cumulative impact would therefore only occur if those same receptors are directly affected. Whilst indirect impacts have been assessed in this chapter (at the wider regional scale e.g. several developments may affect drainage systems or ESS) these have been assessed as having no or negligible impact. The CIA for land use and agriculture therefore only assesses impacts and projects where a direct overlap occurs.

249. The assessment of cumulative impact has been undertaken here as a two stage process. Firstly, all the impacts from previous sections have been assessed for the potential to act cumulatively with other projects. This summary assessment is set out in Table 21.18.

Table 21.18 Potential cumulative impacts

Impact		Potential for cumulative impact	Rationale
Construction			
1	Drainage	Yes	Cumulative direct impacts arising from two or more projects are possible given the level of uncertainty regarding the presence and location of drainage systems. Impacts may occur to individual field drains in any area of overlap or those with an extent which intersects two or more proposed development boundaries (where groundworks are anticipated).
2	Land taken out of existing use	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect local productivity (e.g. loss of earnings from more than one project taking the same parcels of land out of use). Changes to ALC grades of land may also occur as an indirect impact.
3	Natural resource - soil	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect local productivity (e.g. loss of earnings from more than one project taking the same parcels of land out of use). Changes to ALC grades of land may also occur as an indirect impact.
4	Soil erosion	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect local productivity (e.g. loss of earnings from more than one project taking the same parcels of land out of use). Changes to ALC grades of land may also occur as an indirect impact.
5	ESSs	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect land under ESS (e.g. loss of earnings from ESS more than one project taking the same parcels of land out of use).
6	Utilities	No	Potentially affected utility providers would be contacted and the location of existing services would be identified prior to works to ensure there would be no impact.
Operation			
1	Drainage	No	Due to the reinstatement of all drainage post construction and adherence with the flood risk assessment, no cumulative impacts are predicted during operation.

Impact		Potential for cumulative impact	Rationale
2	Permanent change to land use	Yes	Cumulative impacts may occur at a county scale where impacts to productivity affect the wider agriculture industry.
3	ESS	Yes	Cumulative direct impacts arising from two or more projects are possible. Impacts may occur where project boundaries overlap spatially or temporally on the same landowner/occupier's land. Such impacts have the potential to affect land under ESS (e.g. loss of earnings from ESS more than one project taking the same parcels of land out of use).
4	Utilities	No	Potentially affected utility providers would be contacted and the location of existing services would be identified prior to works to ensure there would be no impact.
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.			

250. The second stage of the CIA is an assessment of whether there is spatial overlap between the extent of potential effects of the onshore infrastructure 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 21.7 have also been identified. Where there is an overlap, an assessment of the cumulative magnitude of effect is provided.

251. Projects identified for potential cumulative impacts that were agreed as part of the Norfolk Boreas PEIR consultation. These projects, as well as any relevant development applications submitted since this consultation considered projects and their anticipated potential for cumulative impact are detailed in Table 21.19.

252. The remainder of this section details the nature of the cumulative impacts against all those receptors scoped in for cumulative assessment.

Table 21.19 Summary of projects considered for the CIA in relation to land use and agriculture

Project	Status	Development period	[10]Distance from Norfolk Boreas site (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 32 - between substation locations	Full ES available: https://infrastructure.planninginspectorate.gov.uk/projects/eastern/hornsea-project-three-offshore-wind-farm/	High	Yes	Overlapping proposed project boundaries at Reepham 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	No	Due to the completion of the project, there are no potential direct or indirect potential cumulative impacts during construction. For operational impacts, the Dudgeon Offshore Wind Farm is part of the baseline in the main assessment (section 21.6), therefore no potential cumulative impacts are proposed.

[10] Shortest distance between the considered project and Norfolk Boreas – unless specified otherwise.

Project	Status	Development period	[10]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
A47 corridor improvement programme – North Tuddenham to Easton	Pre-application (application due 2020)	Start works April 2021 Open May 2023	26.7	https://highwaysengland.co.uk/projects/a47-north-tuddenham-to-easton-improvement-scheme/	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
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	No direct overlap and therefore no potential cumulative impacts on the same receptors.
A47 corridor improvement programme – A47 / A11 Thickthorn Junction	Pre-application (application due 2019)	Start works 2020 Open 2023	18	https://highwaysengland.co.uk/projects/a47-thickthorn-junction/	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
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	No direct overlap and therefore no potential cumulative impacts on the same receptors.
Third River Crossing, Great Yarmouth	Pre-application (application due 2019)	Expected construction start in late 2020 Open early 2023	28	https://www.norfolk.gov.uk/roads-and-transport/major-projects-and-improvement-plans/great-	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.

Project	Status	Development period	[10]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
				yarmouth/third-river-crossing			
King's Lynn B Power Station amendments	Approved	Expected construction start 2019 to 2022	28	https://www.kingslynnbccgt.co.uk/	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
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	No direct overlap and therefore no potential cumulative impacts on the same receptors.
Bacton and Walcott Coastal Management Scheme	Approved	Expected construction start date Spring 2019	1	Public information leaflets available: https://www.north-norfolk.gov.uk/media/3371/bacton-to-walcott-public-information-booklet-july-2017.pdf	Medium	No	Coastal protection scheme is restricted to the beach/intertidal area and therefore there are no direct or indirect cumulative impacts anticipated.
Coastal defence/protection	Approved	Coastal protection	0.12	https://idoxpa.north-	Medium	No	Coastal protection scheme is restricted to the beach/intertidal area and therefore there are no

Project	Status	Development period	[10]Distance from Norfolk Boreas site (km)	Project definition	Project data status	Included in CIA	Rationale
works, Happisburgh PF/18/0751		over 10-year duration from August 2018		norfolk.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=_NNORF_DCAPR_93543			direct or indirect cumulative impacts anticipated.
Breckland Council							
Erection of 85 Dwellings with Associated Open Space 3PL/2018/1246/F	Awaiting Decision	Application received 04/10/18.	1.26	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2018/1246/F&from=planningSearch	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.
Residential development of 40 No. units comprising a mix of housing types, accommodating open space and appropriate associated infrastructure with vehicle access via Hall Road 3PL/2018/0993/F	Approved	Application approved 11/02/19. Construction must begin within 2 years.	1.42	http://planning.breckland.gov.uk/OcellaWeb/planningDetails?reference=3PL/2018/0993/F&from=planningSearch	Medium	No	No direct overlap and therefore no potential cumulative impacts on the same receptors.

253. In summary, the following projects will be assessed for potential direct cumulative impacts:

Scenario 1

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

Scenario 2

- Hornsea Project Three Offshore Wind Farm.

254. Under Scenario 2 Norfolk Vanguard does not proceed to construction and therefore under this scenario is not considered as part of the CIA.

255. Under Scenario 1 the installation of ducts for the onshore cable route for Norfolk Boreas will be installed be Norfolk Vanguard. Therefore, the elements of Norfolk Vanguard that are considered in the CIA are the Norfolk Vanguard cable pulling and construction of onshore project substation (including the National Grid substation extension, any landscaping or planting, and the onshore 400kV cable route).

256. 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.

21.8.1 Cumulative Impacts during Construction

21.8.1.1 Cumulative Impact 1: Drainage

21.8.1.1.1 Scenario 1

Norfolk Boreas, Norfolk Vanguard and Hornsea Project Three

257. Due to the geographical overlap between Norfolk Boreas and Norfolk Vanguard and Hornsea Project Three there is the potential for direct cumulative impacts upon drainage systems during construction.

258. As set out in section 21.7.4.1, potential impacts related to construction works are those related to intrusive groundworks associated with the various projects, should they occur. The extent of any impact will depend on the presence and location of field drains. Any adverse effects would be temporary and reversible for the duration of construction. In the absence of mitigation, direct cumulative magnitude of effect on drains would be considered to be medium, on a medium sensitivity receptor as they have a limited capacity to accommodate changes such as degradation or poor reinstatement, resulting in an impact of **moderate adverse** significance**.**

259. However, both Norfolk Vanguard and Hornsea Project Three are subject to EIA and therefore anticipated to adopt mitigation strategies which will seek to avoid, reduce

or offset the effects of direct impacts upon drainage. Hornsea Project Three have included in their ES (Ørsted, 2018) that specific measures for maintenance and reinstatement, where reasonably practicable, of existing water supplies, irrigation facilities and drainage systems during the construction process will be undertaken. Norfolk Vanguard have outlined in their ES (Norfolk Vanguard Limited, 2018) that the proposed strategies include a specialist drainage contractor to locate and draw plans of drainage systems, pre-construction Drainage Plan and installing cables at a depth where they will be laid below the level of typical field drainage pipes to minimise impacts and interaction; and are therefore in line with those proposed for Norfolk Boreas. These measures are expected to reduce the magnitude of effect to low, and as such, these strategies are considered highly likely to result in a residual impact of **minor adverse**.

21.8.1.1.2 Scenario 2

Norfolk Boreas and Hornsea Project Three

260. Under Scenario 2 cumulative impacts would only exist with Hornsea Project Three. The extent of any impact will depend on the presence and location of field drains. Any adverse effects would be temporary and reversible and would be limited to the excavations at the jointing pit locations. In absence of mitigation, direct cumulative magnitude would be considered to be low, on a medium sensitivity receptor, resulting in an impact of **minor adverse** significance.

261. The mitigation strategies as detailed in Scenario 1 would be applied, these measures are expected to reduce the magnitude of effect to negligible, and the residual impact will remain as **minor adverse**.

21.8.1.2 Cumulative Impact 2: Land taken out of existing use/disruption to agricultural practices

21.8.1.2.1 Scenario 1

Norfolk Boreas and Norfolk Vanguard - onshore cable route

262. Due to the geographical overlap between Norfolk Boreas and Norfolk Vanguard cable routes there is the potential for cumulative impacts as the area of land taken out of agricultural use during construction.

263. For the onshore cable route under Scenario 1 the impacts are limited to those associated with the cable pulling, for Norfolk Vanguard the impacts will be similar to those under Norfolk Boreas Scenario 2. In the absence of mitigation, the cumulative magnitude of effect on land taken out of use would be considered to be medium, on a high sensitivity receptor, resulting in an impact of **major adverse** significance.

264. However, Norfolk Vanguard have outlined in their ES that they will be adopting the same mitigation strategies as Norfolk Boreas as outlined in section 21.7.4.2.1. These

measures are expected to reduce the magnitude of effect to low, and as such, the residual cumulative impact of both projects is therefore expected to be **minor adverse**.

Norfolk Boreas and Norfolk Vanguard - onshore project substation and National Grid substation extension

265. For the onshore project substation and National Grid substation extension the co-location of the Norfolk Boreas and Norfolk Vanguard onshore project substations could lead to potential cumulative impacts, as the area of land taken out of agricultural use during construction would increase. In the absence of mitigation, the cumulative magnitude of effect on land taken out of use would be considered to be medium, on a high sensitivity receptor, resulting in an impact of **major adverse** significance.

266. However, Norfolk Vanguard outlined a number of mitigation strategies in their ES, consistent with those outlined for Norfolk Boreas is section 21.7.4.2 , which seek to avoid, reduce or offset the effects of direct impacts upon land take. These measures are expected to reduce the magnitude of effect to low, and as such, the residual cumulative impact of the two projects is considered to be **minor adverse**.

21.8.1.2.2 Scenario 1 and Scenario 2

Norfolk Boreas and Hornsea Project Three

267. Land taken out of use for Hornsea Project Three and Norfolk Boreas where the cables intersect would be reinstated following construction; therefore, **no impact** is predicted cumulatively for these two projects.

21.8.1.3 Cumulative Impact 3: Degradation of natural resources - soil

21.8.1.3.1 Scenario 1

Norfolk Boreas and Norfolk Vanguard

268. The construction of Norfolk Boreas under Scenario 1 would lead to **negligible** impact on the soil resource, whilst the construction of the Norfolk Vanguard project would lead to a **minor adverse** impact on the soil resource. The cumulative impact of the two projects is considered to be **minor adverse**.

21.8.1.3.2 Scenario 1 and 2

Norfolk Boreas and Hornsea Project Three

269. Land taken out of use for Hornsea Project Three and Norfolk Boreas where the cables intersect would be reinstated following construction; therefore, **no impact** is predicted cumulatively for these two projects.

21.8.1.4 Cumulative Impact 4: Loss of soil resource - erosion

21.8.1.4.1 Scenario 1

Norfolk Boreas and Norfolk Vanguard

270. The construction of Norfolk Boreas under Scenario 1 would lead to **negligible** impacts. The construction of the Norfolk Vanguard project would be **minor adverse** and therefore the cumulative impact of the two projects is considered to be **minor adverse**.

21.8.1.4.2 Scenario 1 and Scenario 2

Norfolk Boreas and Hornsea Project Three

271. Land taken out of use for Hornsea Project Three and Norfolk Boreas where the cables intersect would be reinstated following construction; therefore, **no impact** is predicted cumulatively for these two projects.

21.8.1.5 Cumulative Impact 5: ESS

21.8.1.5.1 Scenario 1

Norfolk Boreas and Norfolk Vanguard

272. The construction of Norfolk Boreas under Scenario 1 would lead to negligible impacts on ESS on the onshore cable route and at the landfall. The construction of Norfolk Vanguard would also lead to negligible impacts on ESS.

273. There are no ESS's at the onshore project substation or National Grid substation extension, therefore no potential for cumulative impacts.

274. As stated in the Norfolk Vanguard ES; a commitment will be made within the private agreements between Norfolk Vanguard Limited and the landowner/occupier to compensate for losses incurred due to potential impacts on ESS during the construction phase of the project. This approach is also being adopted by Norfolk Boreas and therefore the cumulative impact of both projects is expected to remain as **negligible**.

21.8.1.5.2 Scenario 1 and Scenario 2

Norfolk Boreas and Hornsea Project Three

275. Land taken out of use for Hornsea Project Three and Norfolk Boreas where the cables intersect would be reinstated following construction; therefore, **no impact** is predicated cumulatively for these projects.

21.8.1.6 Cumulative Impact 6: Utilities

21.8.1.6.1 Scenario 1 and Scenario 2

Norfolk Boreas, Norfolk Vanguard and Hornsea Project Three

21 The onshore cable route has been selected to avoid major utilities where possible/practicable. Therefore, **no impact** is predicted, and Norfolk Boreas would therefore not cause cumulative impacts on utilities during construction.

21.8.2 Cumulative Impacts during Operation

21.8.2.1 Cumulative Impact 1: Drainage

21.8.2.1.1 Scenario 1 and Scenario 2

Norfolk Boreas, Norfolk Vanguard and Hornsea Project Three

276. Due to the reinstatement of all drainage post construction and adherence with the FRA, **no impact** is predicted during operation, therefore Norfolk Boreas would not cause cumulative impacts on drainage during operation.

21.8.2.2 Cumulative Impact 2: Land taken out of use (Permanent)

21.8.2.2.1 Scenario 1

Norfolk Boreas, Norfolk Vanguard and Hornsea Project Three

277. The land areas of the onshore project substation and National Grid substation extension for Norfolk Boreas and Norfolk Vanguard would be taken permanently out of use. This impact is minor adverse at the wider county level.

278. Norfolk Vanguard will be utilising the same onshore cable route as Norfolk Boreas, and this would only affect land owners when access is required. In terms of access requirement, the same situation is anticipated for Hornsea Project Three. Therefore, the cumulative impact would not increase above **minor adverse**.

21.8.2.2.2 Scenario 2

Norfolk Boreas and Hornsea Project Three

279. The onshore cables routes for Norfolk Boreas and Hornsea Project Three would only affect land owners when access is required. Therefore, the cumulative impact would not increase above **minor adverse**.

21.8.2.2.3 Cumulative Impact 3: Degradation of Natural Soil Resource

21.8.2.2.4 Scenario 1 and Scenario 2

Norfolk Boreas, Norfolk Vanguard and Hornsea Project Three

280. There will be no earthworks during operation, therefore **no impact** is predicted and Norfolk Boreas would therefore not cause cumulative impacts on degradation of natural soil resource during operation.

21.8.2.3 Cumulative Impact 4 Loss of Soil Resource

21.8.2.3.1 Scenario 1 and Scenario 2

Norfolk Boreas, Norfolk Vanguard and Hornsea Project Three

22 There will be no earthworks during operation, therefore **no impact** is predicted and Norfolk Boreas would therefore not cause cumulative impacts on loss of soil resource during operation.

21.8.2.4 Cumulative Impact 5: ESS

21.8.2.4.1 Scenario 1 and Scenario 2

Norfolk Boreas, Norfolk Vanguard and Hornsea Project Three

281. There are no ESSs at the Norfolk Vanguard or Norfolk Boreas onshore project substations or associated National Grid substation extensions therefore no impact is predicted cumulatively.

282. Along the onshore cable route, land would be reinstated during operation, with the exception of link boxes (a total of 24 link boxes, 2.25m^2 per link box under the worst case assumptions). Due to minor scale of total land affected; the predicted cumulative impact would not increase above **negligible**.

21.8.2.5 Cumulative Impact 6: Utilities

21.8.2.5.1 Scenario 1 and Scenario 2

Norfolk Boreas, Norfolk Vanguard and Hornsea Project Three

283. As described in section 21.6.7, potentially affected utility providers would be contacted, and the location of existing services would be identified prior to maintenance works to ensure there would be no impact. Therefore, **no impact** is predicted, and Norfolk Boreas would therefore not cause cumulative impacts on utilities during operation.

21.8.3 Cumulative Impacts during Decommissioning

284. 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.

21.9 Inter-relationships

285. Parameters or 'sources' that are considered to interact with receptors identified in this chapter are listed in Table 21.20.

Table 21.20 Inter-relationships with land use and agriculture

Inter-relationship and linked chapter	Section where addressed	Rationale
Chapter 19 Ground Conditions and Contamination	21.6, 21.7, 21.8	Changes in soil quality could impact on ground conditions and potential contaminated land.
Chapter 20 Water Resources and Flood Risk	21.7, 21.8	Potential impacts on drainage could lead to changes in flood risk or water resources e.g. private water supplies
Chapter 22 Onshore Ecology	21.6, 21.7, 21.8	Changes to land uses could impact on ecological receptors for example the removal of trees or hedgerows or the loss of agricultural land.
Chapter 24 Traffic and Transport	21.6, 21.7, 21.8	Changes in land uses e.g. at roads or paths could affect traffic and transport.
Chapter 28 Onshore Archaeology and Cultural Heritage	21.6, 21.7	Potential impacts on land use could affect any buried archaeology present.
Chapter 29 Landscape and Visual Impact Assessment	21.6, 21.7, 21.8	Changes to land uses could impact on the landscape and visual amenity.
Chapter 31 Socio-economics	21.6, 21.7, 21.8	Changes in the agricultural industry may affect the socio-economics of the region.

21.10 Interactions

286. 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 21.21, along with an indication as to whether the interaction may give rise to synergistic impacts.

Table 21.21 Interaction between impacts

Potential interaction between impacts						
Construction						
	1 Drainage	**2 Land taken out of existing use**	**3 Degradation of natural resources - soil**	**4 Erosion of soil**	**5 ESS**	**6 Utilities**
1 Drainage	-	Yes	Yes	Yes	No	No
2 Land taken out of existing use	Yes	-	Yes	Yes	Yes	Yes
3 Degradation of natural resources - soil	Yes	Yes	-	Yes	Yes	No
4 Erosion of soil	Yes	Yes	Yes	-	Yes	No
5 ESS	No	Yes	Yes	Yes	-	No
6 Utilities	No	Yes	No	No	No	-
Operation						
	1 Drainage		**2 Permanent land use change**	**3 ESS**	**4 Utilities**	
1 Drainage	-		Yes	No	No	
2 Permanent land use change	Yes		-	Yes	No	
3 ESS	No		Yes	-	No	
4 Utilities	No		No	No	-	
Decommissioning						
It is anticipated that the decommissioning impacts will be similar in nature to those of construction.						

21.11 Summary

287. A summary of the potential impacts identified with relation to land use and agriculture is provided in Table 21.22 and Table 21.23 for Scenario 1 and Scenario 2 respectively.

288. Provided mitigation measures are in place, under both scenarios the project is predicted to have only **negligible** to **minor adverse** impacts. Mitigation measures include the use of an ALO, ensuring agricultural field drains are maintained, and employing best practice measures through a SMP and CoCP.

Table 21.22 Potential impacts identified for land use and agriculture Scenario 1

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional mitigation	Residual impact
Construction						
1	Drainage	Medium	Low	**Minor adverse**	Yes – Drainage contractors, Drainage Plan, CoCP	**Negligible**
2	Land taken out of existing use/disruption to agricultural activities	High	Low	**Moderate adverse**	Yes – SMP, private agreements	**Minor adverse**
3	Degradation of natural resources - soil	Low	Negligible	**Negligible**	Yes – SMP, private agreements	**Negligible**
4	Loss of soil resource – soil erosion	Low	Low	**Minor adverse**	Yes – private agreements	**Negligible**
5	ESSs	Medium	Negligible	**Minor adverse**	Yes – private agreements	**Negligible**
6	Utilities	N/A	N/A	**No impact**	N/A	**No impact**
Operation						
1	Drainage	N/A	N/A	**No impact**	N/A	**No impact**
2	Permanent land use change	High	Low	**Moderate adverse**	Yes – private agreements	**Minor adverse**
3	ESSs	Medium	Negligible	**Minor adverse**	Yes – private agreements	**Minor adverse**
4	Utilities	N/A	N/A	**No impact**	N/A	**No impact**
Decommissioning						
It is anticipated that the decommissioning impacts will be no worse than those for construction.						
Cumulative - construction						
1	Drainage	Medium	Medium	**Moderate adverse**	Yes – drainage contractor, Drainage Plan, CoCP	**Minor adverse**
2	Land taken out of existing use/disruption to agricultural activities	High	Medium	**Major adverse**	Yes – SMP, private agreements	**Minor adverse**
3	Degradation of natural resources - soil	Low	Low	**Minor adverse**	Yes – SMP, private agreements	**Minor adverse**

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional mitigation	Residual impact
4	Loss of soil resource – soil erosion	Low	Medium	**Minor adverse**	Yes – private agreements	**Minor adverse**
5	ESSs	Medium	Negligible	**Minor adverse**	Yes – private agreements	**Minor adverse**
Cumulative - operation						
1	Drainage	N/A				
2	Permanent change to land use	High	Low	**Moderate adverse**	Yes – private agreements	**Minor adverse**
3	ESSS	Medium	Negligible	**Minor adverse**	Yes – private agreements	**Minor adverse**
4	Utilities	N/A				
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 21.23 Potential impacts identified for land use and agriculture Scenario 2

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional mitigation	Residual impact
Construction						
1	Drainage	Medium	Low	**Minor adverse**	Yes –Drainage contractor, Drainage Plan, CoCP	**Negligible**
2	Land taken out of existing use/disruption to agricultural activities	High	Medium	**Major adverse**	Yes – SMP, private agreements	**Minor adverse**
3	Degradation of natural resources - soil	Low	Low	**Minor adverse**	Yes – SMP, private agreements	**Negligible**
4	Loss of soil resources – soil erosion	Low	Medium	**Minor adverse**	Yes – private agreements	**Negligible**
5	ESSs	Medium	Negligible	**Minor adverse**	Yes – private agreements	**Negligible**
6	Utilities	N/A.	N/A	**No impact**	N/A	**No impact**
Operation						
1	Drainage	N/A	N/A	**No impact**	N/A	**No impact**
2	Permanent land use change	High	Low	**Moderate adverse**	Yes – private agreements	**Minor adverse**
3	ESSs	Medium	Negligible	**Minor adverse**	Yes – private agreements	**Minor adverse**
4	Utilities	N/A	N/A	**No impact**	N/A	**No impact**
Decommissioning						
It is anticipated that the decommissioning impacts will be no worse than those for construction.						
Cumulative - construction						
1	Drainage	Medium	Low	**Minor adverse**	Yes – drainage contractor, Drainage Plan, CoCP	**Minor adverse**
2	Land taken out of existing use/disruption to agricultural activities	No impact				
3	Degradation of natural resources - soil	No impact				
4	Loss of soil resources – soil erosion	No impact				
5	ESSs	No impact				

Potential Impact	Receptor	Sensitivity	Magnitude	Significance	Additional mitigation	Residual impact
Cumulative - operation						
1	Drainage	N/A				
2	Permanent change to land use	As per operation				
3	ESS	As per operation				
4	Utilities	N/A				
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.						

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